SCIENCE

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FRIDAY, FEBRUARY 5, 1897.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

A NATIONAL UNIVERSITY.

THE reconstruction of the University of Paris, the efforts in and out of the British Parliament to make a University of London, the great success of the University of Berlin, and the renewed advocacy of a National University at Washington, indicate a movement which, we believe, makes for the progress of education and science. There are dangers in centralization, but these are small in comparison with the promise of great centers, where specialization and coöperation can be carried forward to the degree demanded by the present state of learning and science.

It is not necessary to take up space in this JOURNAL to set forth in detail facts on which we are all agreed—that universities are necessary for the progress and even the preservation of our present civilization; that America should have universities equal to those of any other country; that the founding of new universities, such as Johns Hopkins, Chicago and Stanford has been productive of good; that the establishment by gifts or bequests of a university at Washington greater than any other would be received with universal satisfaction. It is, however, desirable to consider the objec-

tions that have been urged against the establishment, by the government, of a national university at Washington. These may be reduced to three: the cost of maintenance, the risk of political intermeddling and the alleged interference with existing institutions.

A national university should be supported by liberal appropriations, but the cost is not as great as is sometimes supposed. The annual salaries paid at Berlin amount to less than $200,000. The United States spends about $175,000,000 annually on its common schools. No one grudges this large sum, and yet it is spent chiefly for the benefit of the individual, whereas the higher education is chiefly for the benefit of the state. All the money spent on universities since the first beginnings at Paris and Salerno has been paid back by the results of the education of one man such as Faraday or Pasteur. Higher education in America has been liberally endowed by rich men, but if it is desirable to have these endowments it seems needless to be dependent on individual initiative. Whether the money come from endowments or from taxation it must be taken from the wealth of the country. It may represent a part of the extra price paid for each gallon of kerosene oil, or it might result from a tax paid on the $10,000,000 worth of precious stones annually imported and used chiefly for purposes of ostentation. We might as well wait for rich men to give our government ships of war as to be dependent on them for our educational institutions. A university supported directly by the people would have peculiar influence and special dignity.

There is, perhaps, a more serious question as to whether the representatives of the people at Washington are competent to manage a university. Might they not regard it as part of the spoils of victory? We think the risk is slight and transient. The Smithsonian Institution and the Military Academy at West Point have not become involved in practical politics, and the State universities have in nearly all cases not only remained non-partisan, but have set a salutary example to other departments. A national university should not offer patronage and high salaries, but permanency of office, the most perfect facilities for research and publication, the ablest students to teach and the best intellectual environment. It would by its own nature be self-conservative. A national university would not only be, in all probability, itself free from political influences, but would tend to preserve the scientific bureaus from these and to purify and elevate all offices under the government.

It may be said that our existing universities supply the need and that a new university would interfere with these. This was not the opinion of the heads of Cornell, Pennsylvania and Stanford Universities, who have been among the ablest and wisest advocates of a national university. The growth of the University of Berlin has not weakened the other German universities. A great national university would be the head of our educational system. It would not interfere with existing universities any more than these interfere with our colleges or our colleges with our schools. Our present universities consist chiefly of professional schools, on the one hand, and of col-

leges for the instruction of boys, on the other. They are, indeed, developing toward true universities, but nothing could better hasten and direct this development than a national university.

From a theoretical point of view it would seem that all the arguments which have been urged against the establishment of a national university turn out to be in its favor. The cost, the incompetence of government and the claim that existing universities suffice are, however, practical difficulties which we do not underestimate. Indeed, these are so evident that we should regard it as useless to advocate the immediate establishment of a great national university. We rather hope for a gradual growth from the national institutions already existing at Washington.

We have there great libraries, museums and laboratories, able investigators engaged in advancing pure and applied science, and younger men learning from them the methods of research. These are the essentials of a university. No university in the world includes so many or such able investigators, teachers and students of geology as the U. S. Geological Survey, and in many departments the work at Washington surpasses any American university in the amount of investigation accomplished and in the number of investigators trained.

We should recommend the development of the Bureau of Education somewhat in the direction of the University of the State of New York. Let it have power to regulate academic degrees and to confer them. Degrees may belong to an immature civilization, but this is just the kind of civilization of which we must make the best. Workers in the different government divisions and others having the proper preliminary education could, on presenting a thesis showing original work and passing an examination, receive the doctorate of philosophy, and this would qualify them as a civil service examination for promotion. The present Commissioner of Education, and perhaps the regents of the Smithsonian Institution, could govern the university. Examiners could be appointed from leading representatives of science and learning who would meet yearly for a week of convocation in Washington. We believe that, without radical changes and with nominal expense, there could be established at Washington a national university likely to become the world's greatest university.

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*SCIENCE AND PSEUDO-SCIENCE IN MEDICINE.**

ONE of the definitions given by Webster for the term 'science' is: "Truth ascertained; that which is known. Hence, specifically, knowledge duly arranged, and referred to general truths and principles upon which it is founded and from which it is derived; a branch of learning considered as having a certain completeness." Having this definition in view I think we are justified in speaking of medicine as a science. No doubt it is incomplete in many directions, but by the application of scientific methods of research such rapid progress has been made during the past fifty years that to-day medicine stands upon a substantial basis of 'truth ascertained' in all of its departments, and when we consider the breadth of the field covered by these various departments the lacunæ, in our knowledge, are no greater than in many other

*Read before the Anthropological Society of Washington, December 15, 1896.

branches of science, *e. g.*, in physics or in geology.

Evidently scientific medicine must be founded upon an exact knowledge of the structure (anatomy) and functions (physiology) of the human body in a healthy condition and of the changes in structure and function (pathology) which result from various disease processes; of the causes (etiology) natural history (clinical medicine) and regional distribution (medical geography) of the diseases which afflict mankind and the lower animals (comparative pathology); of the toxic action of various substances from the animal and vegetable kingdom (toxicology) and of the use of these and of other nontoxic substances, physical agents, etc., in the treatment of disease (therapeutics). For the illiterate and even for many of the so-called educated class the whole of medicine consists in the cure of disease by medicines, or by some agency, natural or supernatural, and a failure to cure is evidence that medicine is not a science. We readily admit that the cure of disease is one of the principal objects which medical science has in view and that from a scientific standpoint therapeutics is very much behind some of the other branches of medicine. This is shown by the diversity of remedies prescribed for certain diseases and the failure of any one of these remedies to effect a cure in many cases. But, on the other hand, therapeutics has made great advances during recent years and by the application of scientific methods of research the exact value of alleged remedies and of various methods of treatment is now determined with far greater precision than formerly.

A few years ago the intelligent and honest physician did not claim to have any considerable number of specific remedies at his command; but his scientific knowledge relating to the cause, symptoms and pathology of disease enabled him to conduct many cases to a successful termination which without his assistance would have proved fatal. By the use of scientific instruments and methods of investigation he was able to make an early diagnosis and to give advice which might stay the progress of a disease which in its more advanced stages it would have been beyond his skill to arrest. Recently several additions have been made to the list of specific therapeutic agents and there is good reason to believe that further discoveries in this direction will be made as a result of investigations now being conducted in pathological laboratories in various parts of the world. Among the most important recent discoveries in this department of scientific medicine we may mention the use of thyroid extract for the cure of myxœdema, the antitoxin of diphtheria and the antitoxin of tetanus. The wonderful triumphs of modern surgery, the scientific precision of the methods employed by the skilled ophthalmologist and the achievements of the scientific obstetrician can only be referred to *en passant* in support of the statement that we are to-day justified in speaking of medicine as a science.

While, as we have said, the cure of disease is one of the principal objects which medical science has in view, this is by no means the sole object. Sanitary science is a branch of medicine based upon chemical and physiological knowledge which has been gained by the painstaking researches of a host of investigators who have determined the constituent elements of the air we breathe, the water we drink, the food we eat, and the nature of the harmful impurities which are found in these; it teaches us the difference between healthful indulgence in food, exercise, mental activity, etc., and those excesses which lower the vital resisting power and establish a predisposition to disease. Preventive medicine, which is a broader term, if we regard the beneficent

results accomplished, must be placed in advance of therapeutics. Where thousands have been saved by the timely administration of suitable medicines, or by the skillfully performed operation of the surgeon, tens of thousands have been saved by preventive medicine. And preventive medicine is to-day established upon a strictly scientific foundation. If our practice was *pari passu* with our knowledge infectious diseases should be almost unknown in civilized countries and those degenerative changes of vital organs which result from excesses of various kinds would cease to play a leading part in our mortuary statistics. But while our knowledge is still incomplete in some directions, and while individuals and communities constantly fail to act in accordance with the well-established laws of health and the scientific data which furnish the basis of preventive medicine, the saving of life directly traceable to this knowledge is enormous.

Small-pox no longer claims its victims in any considerable numbers except in communities where vaccination is neglected; the last extended yellow fever epidemic in the United States occurred nearly twenty years ago; cholera has been excluded from our country during the last two widespread epidemics in Europe and its ravages have been greatly restricted in all civilized countries into which it has been introduced; the deadly plague of the 17th and 18th centuries is no longer known in Europe, and the prevalence of typhus (so-called 'spotted' or 'ship fever') has been greately limited. Typhoid fever, tuberculosis and diphtheria are still with us and claim numerous victims, but we know the specific cause of each of these diseases; we know where to find the bacteria which cause them and the channels by which they gain access to the human body; we know how to destroy them by the use of disinfecting agents ('antiseptics'); and in the case of diphtheria we have recently discovered a specific mode of treatment which when promptly applied reduces the mortality from this dread disease to a comparatively small figure.

The brilliant success which has attended the carrying out of modern antiseptic and aseptic methods in surgical and obstetrical practice are too well known to call for extended remark.

Sir Edwin Arnold in an address delivered in 1895 at St. Thomas' Hospital, upon 'Medicine, its past and future,' says:

> "One of the high authorities already quoted has furnished a calculation of the salvage of life effected even during the early years of the present reign by the commencing improvements in preventive and curative medicine. In the five years from 1838 to 1842, London with an average population of 1,840,865 persons, had an average annual mortality of 2,557 in every 100,000. In the five years from 1880 to 1884 the average metropolitan population was 3,894,261, and the average annual death-rate 2,101 in each 100,000. A calculation will show that these figures represent a saving or prolonging of lives during that lustrum to the number of 96,640. The mean annual death-rate has now been reduced to a point lower than shown in these figures. It was 22.16 per 1,000 for England and Wales at the commencement of the reign, and it is to-day better than 19.0 per 1,000, while in Her Majesty's army and navy the diminution of mortality apart from deaths from warfare has proved even more remarkable, and in India, where we used to lose 69 per 1,000 yearly, this has been reduced to 16 per 1,000."

Having thus briefly referred to the present status of scientific medicine I shall devote the remainder of my time to a consideration of the second theme included in the title of this paper, viz.: Pseudo-science in medicine.

History shows us that the development of each branch of science has been accompanied by unfounded inferences, based upon partial knowledge, which have been abandoned by the learned as the science has become established upon a basis of ascertained facts, but which have continued to pass current among the ignorant, often

for centuries after they have been abandoned by the well-informed. Thus, astrology, alchemy, phrenology, homeopathy and 'Christian Science' have met with acceptance not only by the ignorant, but by many of the so-called educated class. As a matter of fact, a scholastic and classical education does not greatly aid in the differentiation between science and pseudo-science; and at the present day many persons who belong to the 'educated class' and even to the learned professions are led astray by claims made upon what appears to them to be a scientific basis. Unless the spirit of scientific scepticism, which demands absolute demonstration before final acceptance, has been cultivated by special training, there is always a liability to be misled by the specious claims of pseudo-scientific pretenders, or of the still more dangerous charlatans who believe in themselves and their pseudo-discoveries. And even among those who have had a more or less complete scientific training it often happens that there is a natural tendency to generalize from insufficient data and to jump at conclusions in advance of the experimental evidence which alone could justify them. Such men are even more dangerous in the ranks of scientific workers than they would be as theorists who ignored the value of scientific research; and many pseudo-scientific discoveries which have passed current for a time, and the refutation of which has been held to show the uncertainty of scientific deductions, have been made by men of this class, whose mental characteristics entirely unfit them for scientific research.

Hand in hand with the progress of medical science we see an army of pseudo-scientific quacks who trade upon the imperfect knowledge of the masses, and by plausibly written advertisements convince many, even of the educated classes, that their particular method of treatment is based upon the latest scientific discoveries. A Priestley discovers oxygen; the physiologists show that this gas is essential to life and that the maintenance of a full degree of vital activity depends upon the possession of healthy lungs of ample capacity and the respiration of pure air; the scientific physician discovers defects in the respiratory apparatus and under certain circumstances prescribes oxygen for the relief of symptoms resulting from a deficient supply of this life-sustaining gas. But the pseudo-scientist extols oxygen as a cure-all for pulmonary complaints, or invents an apparatus which may be held in the hand or carried in the pocket, by which oxygen will be absorbed in some mysterious way, and without difficulty obtains numerous certificates as to the marvelous cures effected by his method. A Franklin draws lightning from the clouds; a Galvani shows that an electric current may be developed by the contact of metals and that such a current causes muscular contraction; and innumerable patient investigators add to our knowledge of electricity. The scientific physician avails himself of this potent agent for the treatment of certain ailments in which it appears to be indicated, but admits that he meets with many disappointments in his clinical experiments. The pseudo-scientific quack writes, or has written, advertisements in which fact and fiction are so commingled that even educated persons may be deceived, and having aroused interest in the alleged therapeutic value of this mysterious agent, offers his electric belt, or finger ring made of two metals, or pocket battery, as a sure cure for certain specified ailments, or, if less modest and more certain of the credulity of the public, as a cure for all of the diseases to which man is subject.

Again, a Pasteur proves that the disease of sheep and cattle known as anthrax is due to a microscopic organism found in

the blood; an Obermeyer discovers a different microorganism in the blood of relapsing fever patients, and numerous patient workers in laboratories rapidly add to our knowledge of pathogenic bacteria. Then comes the man with the microbe killer. He tells you that all diseases are due to germs in the blood and that his fluid kills them without fail. Science has demonstrated that comparatively few of the infectious diseases of man are due to the presence of pathogenic bacteria in the blood, and that the microbe killer has comparatively little germicidal value; but a credulous public accepts the interested statements which appear to have a scientific basis, and swallows the microbe killer with impunity, if not with benefit. And so it goes. Science establishes the value of thyroid extract for the cure of myxedema, and immediately the public are called upon to swallow extracts of brain for cerebral trouble, of heart for cardiac disease, etc. Even the Chinese pulse-doctors obtain a large clientele on the Pacific coast. Their solemn looks and pretentious claims impose upon the ignorant, and it is said that educated people not infrequently consult them.

One of the most successful pseudo-scientific quacks of the present day has written a book in which he gives a history of the alleged discovery of his cure-all and from which I desire to make two or three quotations. One of these shows the author to have been a close observer of the genus homo. He says:

"People should not be led away by every charlatan who jumps up before them and talks; but as long as the world lasts there will probably be fools in it, and fools are a godsend to rogues. There is a fascination in being humbugged. Make it known to the world that you are going to do some impossible thing, and the world will pay money to come in and see you do it, although well understanding all the while that the thing cannot be done."

The financial success of 'the microbe killer' indicates that the discoverer of this alleged cure-all has substantial proof of the truth of the frank statements above quoted. The author's personal experience with microbes is given on another page as follows:

"When I drove to my seed store I knew that I could sit only on the edge of my buggy, because the microbes would not let me sit in any other way, and when I stepped to the ground I knew that it took me several minutes before I could move, the microbes that produced sciatica and rheumatism objecting to being disturbed, and so preventing me. Every attempt to move had to be slow and deliberate, until they should get accustomed to the change. I was a living barometer. Whenever the weather altered, and especially if it became cooler, my collection of microbes could anticipate it two or three days, and when the storm came they would freeze and force me to take refuge by a red-hot stove to get them quieted."

On another page the author states his theory with reference to disease and its treatment as follows: "But I knew that his symptoms were of secondary importance. They were interesting to have, but not essential, because all disease is due to the same cause and requires but one cure." Of course that one cure is the microbe killer and you must beware of imitations. The author describes his unsuccessful attempt to obtain relief from the advertising quacks, as follows:

"Good friends were generous with their advice. I was told to try first one thing then another, but I had become wearied with what I had come to believe was so much humbug, and I determined to swallow no more medicine. I again studied advertisements. There I saw commended electric belts, porous plasters, liniments, lotions and salves, and all sorts of external applications that would cure everything, purify the blood, strengthen the nerves, stimulate the functions of the organs, kill the microbes, and rejuvenate the individual in mind and body. Well, this was something. Whatever such things would or would not do, there was no medicine in them—nothing to swallow, no poison, so, if they did no good, I could not see that they would do harm. The end of my thinking was that I sent off ten dollars to Chicago for an electric belt. Some of the advertising firms fail to respond, as they promise, to money remittances, but my belt came, and I lost no time in fixing it on. It reminded me of former days when I was a soldier, with belt and sabre, in the German

army. Then I jumped ditches eight feet wide, and sang and laughed when others fell into the water, but now things were changed. Then I had health and youth, now I was far older in health than in years, but I concluded that, being but forty-three, if the belt did all that was promised for it, there should be no reason why I might not live forty years or more yet. So I gave the belt a good chance. I wore it faithfully for three months, and tried to help it by covering myself in every likely spot with porous plasters. In that condition I went about my business, clad in a kind of coat armor to fight microbes. I tried to persuade myself that I was doing exactly the right thing, and set to work to find enjoyment among my roses and to forget my troubles.

"But it was of no use. My limbs did not consider that much enjoyment. The microbes were unhappy, and would not be appeased. They gave me no rest; they tortured me unceasingly, and finally they drove me back in despair and desperation to my bed."

These unhappy microbes were finally appeased or destroyed by the 'microbe killer,' and having generously determined to allow his fellow-men to share in the benefits of his wonderful discovery the Texas seedsman soon became rich and famous. His book is illustrated by photomicrographs which are supposed to show the microbes of various diseases. The writer is unable to recognize any known disease germ in these photomicrographs, some of which show, more or less distinctly, epithelial cells, granular débris of the various tissues, yeast cells, pencillium spores, etc.

Another pseudo-scientific 'discovery' which is largely advertised in the monthly journals is the 'Electropoise,' which is described as 'a little instrument which enables the system to take on oxygen freely from the atmosphere. This addition of nature's own tonic increases vitality, tones up the nervous system, purifies the blood, and by expelling the morbid matter and diseased tissues restores the body to its normal condition—health.' The *modus operandi* of this wonderful instrument is more fully explained in the following published certificate (advertisement in *McClure's Magazine*):

"We are slow to commend new discoveries of any kind, for the reason that so many of them prove to be worthless. But we commend the 'Electropoise' as a safe and effective health restorer. We do not pretend to explain the philosophy of its workings, but having realized its beneficial effects we can speak of its results. One might conclude, from its name, that it was an electric battery. But it does not generate electricity and is in no sense a battery, belt, sole, or anything kindred to them. It consists of a small cylinder called a 'polarizer,' which is used in connection with the patient's body by means of a common electric cord. This polarizer causes oxygen from the atmosphere to be absorbed by the entire surface of the body with great rapidity, the strength of the absorption being regulated according to the ability of the patient to receive.

* * * * * * * *

"After a year's use we have this to say in its favor: (1) We have taken no medicine for the year. (2) All traces of la grippe and an old sunstroke trouble have disappeared and no symptoms of either remain. Once or twice, from severe overwork, we have found it necessary to hold up for a few days, but in no time for fifteen years have we been better than during the past year. Much of this we attribute to the use of the 'Electropoise.'

"This notice of the 'Electropoise' is without solicitation and entirely gratuitous. We do it for the good of the afflicted. We have no personal interest in it and are not paid for what we say in its favor. Persons desiring further information can address the agent."—Rev. Wm. McDonald in *Boston Christian Witness*.

We would suggest to the Rev. Wm. McDonald that he try the following simple experiment: Having connected the 'polarizer' with his leg by means of the 'common electric cord,' let him place his one hand over his mouth and nose, thus shutting off oxygen of the atmosphere from the lungs, which have been provided by nature to furnish the necessary supply of this gas. Now let him note by a watch how long the supply of oxygen 'absorbed from the entire surface of the body' will answer as a substitute for nature's method of supplying this gas. We venture also to suggest to the Rev. Wm. McDonald that 'all traces of *la grippe* and of an old sunstroke trouble' might have disappeared during

the year if he had not used the Electropoise. Assuming that this certificate is genuine, it answers very well to illustrate the fact that educated men, who have not been trained in the methods of scientific investigation, often arrive at conclusions entirely unjustified by the evidence before them by the dangerous use of the *post hoc ergo propter hoc* method of argument.

The fact that a considerable proportion of those who are sick from various acute or chronic ailments recover after a time, independently of the use of medicinal agents or methods of treatment, taken in connection with this tendency to ascribe recovery to the treatment employed, makes it an easy matter to obtain certificates of cure for any nostrum which an unprincipled money-seeker may see fit to offer to a credulous public. If ten in a thousand of those who have used the alleged remedy believe themselves to have been benefited, their certificates will answer all purposes of exploitation and the 990 will not be heard from by the general public.

As was to have been expected, the X-ray has already been made a source of revenue by more than one pseudo-scientist. The following account of the *modus operandi* of its supposed therapeutic action has recently been published in the newspapers:

"After the Crookes tube is excited by the coil the magnetic lines of force are projected down in the same manner as they pass off from a magnet, and traversing the intervening space, pass through the body down to the floor, and back to the coil and tube again, completing the circuit.

"The X-ray is electrostatic in character and of a very high potential. With every discharge from the Crookes tube oxygen is liberated in the body, as well as the surrounding atmosphere, which, combining with nascent oxygen, forms ozone.

"It is due to the electrolysis produced in the body that we are able to destroy the bacilli in contagious disease, ozone being the most powerful germicide known."

We remark, first, that we do not fully understand why 'the magnetic lines of force' are reflected back by the floor, 'completing the circuit.' Inasmuch as the X-rays pass through wood, this mysterious action of the floor appears to call for some further explanation.

We will pass by the ingenious explanation of the formation of ozone, as a result of the action of the X-ray, to call attention to the mistaken statement that ozone is 'the most powerful germicide known.'

Upon this point I take the liberty of quoting from the Manual of Bacteriology:

"The experiments of Fränkel show that the aerobic bacteria grow abundantly in the presence of pure oxygen, and some species even more so than in ordinary air.

"*Ozone*—It was formerly supposed that ozone would prove to be a most valuable agent for disinfecting purposes, but recent experiments show that it is not so active a germicide as was anticipated, and that from a practical point of view it has comparatively little value.

"Lukaschewitsch found that one gramme in the space of a cubic metre failed to kill anthrax spores in twenty-four hours. The cholera spirillum in a moist state was killed in this time by the same amount, but fifteen hours' exposure failed to destroy it. Ozone for these experiments was developed by means of electricity.

"Wyssokowicz found that the presence of ozone in a culture medium restrained the development of the anthrax bacillus, the bacillus of typhoid fever, and others tested, but concludes that this is rather due to the oxidation of bases contained in the nutrient medium than to a direct action upon the pathogenic bacteria.

"Sonntag, in his carefully conducted experiments, in which a current of ozonized air was made to pass over silk threads to which were attached anthrax spores, had an entirely negative result. The anthrax bacillus from the spleen of a mouse, and free from spores, was then tested, also with a

negative result, even after exposure to the oxonized air for twenty minutes at a time on four successive days. In another experiment several test organisms (Bacillus anthracis, Bacillus pneumoniæ of Friedlander, Staphylococcus pyogenes aureus, Staphylococcus pyogenes albus, Bacillus muriseptiicus, Bacillus crassus sputigenus) were exposed on silk threads for twenty-four hours in an atmosphere containing 4.1 milligrammes of ozone to the litre of air (0.19 volumes per cent.). The result was entirely negative. When the amount was increased to 13.53 milligrammes per litre the anthrax bacillus and Staphylococcus pyogenes albus failed to grow after twenty-four hours' exposure. The conclusion reached by Nissen, from his own experiments and a careful consideration of those previously made by others, is that ozone is of no practical value as a germicide in therapeutics or disinfection."

From a practical point of view the use of the X-ray in the practice of the Chicago doctor, to whom the above quoted explanation of its therapeutic action is attributed, appears to have been quite successful. He says:

"For the last eight months I have had patients under the X-ray in my laboratory from 9 a. m. to 6 p. m., duration of treatment varying from a-half to four hours at each treatment, and not once with any bad result in any case."

Now it is evident that a physician who has patients coming to his office from 9 a. m. to 6 p. m. every day is in the enjoyment of a very handsome professional income. And if, as I imagine, many of these patients are well-dressed ladies with more leisure than judgment, they are no doubt satisfied to pay well for the opportunity of having the latest *scientific* treatment applied to their cases and to await their turn in the anteroom of this distinguished 'professor of electro-therapeutics.'

The article from which we have quoted, and which appears to answer all the purposes of a free advertisement, concludes as follows:

"It must not be forgotten that electric phenomena are very powerful, and not every man who can buy a machine is capable of applying it. The electric machine must be as skillfully adjusted to each individual as the microscope to a specimen submitted to it. It is a treatment full of danger if ignorantly or rashly handled, but beyond price in value to the skilled and careful electro-therapeutist."

We do not propose to prejudge the question of the possible therapeutic value of the X-ray, but we think it safe to predict that it will not be found of any value for the destruction of pathogenic bacteria in the tissues, inasmuch as it has been shown by several competent observers to have very little, if any, germicidal action; and because there is no experimental evidence which justifies the belief that these low vegetable organisms can be destroyed by any physical or chemical agents which would not at the same time destroy the vitality of the less resistant cellular elements of the tissues.

If time permitted I might further illustrate the temporary successes of recent pseudo-scientific discoveries by referring to the 'cryptococous xanthogenicus' of Domingos Freire, of Brazil, the Bacillus malariæ of Klebs and Tomasi Crudelli, etc., etc.

The spectacle of a learned clergyman, supplied by nature with a brain and a pair of lungs, sitting day after day with an 'electropoise' attached to his leg for the purpose of 'taking on oxygen freely from the atmosphere' recalls the 'blue grass craze' of twenty-five years ago.

George M. Sternberg.
Washington, D. C.

The American Psychological Association.

The fifth annual meeting of the American Psychological Association was held in Boston, Tuesday and Wednesday, December

29 and 30, 1896, under the presidency of Professor G. S. Fullerton, of the University of Pennsylvania. There were three formal sessions of the Association, one on the morning of the 29th, held at the Harvard Medical School, and two sessions on the 30th, held at the Peabody Museum of Archæology in Cambridge. The members of the Association very generally attended the discussion on 'The Inheritance of Acquired Characteristics' before the American Naturalists on the afternoon of the 29th, psychology being represented in the discussion by Professor James, of Harvard. Together with the other affiliated societies, the Psychologists were present at Mr. Agassiz's lecture and reception on Tuesday evening, at the luncheon given by the President and Fellows of Harvard College on Wednesday, and at the formal dinner of the societies at the Hotel Brunswick in Boston, on Wednesday evening. There were forty-five members in attendance, the largest meeting since the organization of the Association. Owing to the number of distinctly philosophical papers, one session of the Association was given up to papers of that character. The scientific program was as follows:

1. *The Physiology of Sensation.* By E. A. SINGER, of the University of Pennsylvania.

States the fundamental question as: What would be an ideally complete physiology of sensation? The method employed in answering the question would establish an analogy between what has been regarded as progress in the past and what should be sought by a progressive psychology of the future. The result of such an analogy is stated in the following form: Wherever we know anything about the psychology of sensation we find that the correlate of a mental difference is a structural physiological difference. Where we are yet in ignorance as to the physiological counterpart of a mental difference we should assume it to be a difference in structure rather than a difference in functioning of the same structure. This view is to be contrasted with such opinions as would regard the physiological counterpart of intensity as the greater or less activity of the same nervous structure; feeling tone as the greater or less disintegration, or as dependent upon conditions of greater or less nutrition of the same structure, etc. Some attempt is made, rather by way of illustration than as framing a completely tenable hypothesis, to suggest a physiology of these so-called properties of sensation that would relate them to quality of sensation. Thus the physiological basis of intensity differences is sought in part in the different end organs affected in greater or less reaction to a stimulus; in part also in special apparatus suggested by the allied nature of intensity and saturation in color sensations. Feeling tone is distinguished from pleasure and pain; the physiology of the former being related to that of the emotion, the physiology of the latter to that of the special senses. Local sign presents the inverse problem as to how sensations conditioned by confessedly different nervous structures should come to be classed together. The answer suggested is that the classing together of locally different sensations and qualitatively similar is conditioned by the formal likeness of the end organs affected, they determining a likeness in the adequate stimuli and in the general way of behaving of the sensation. Recognized likeness and difference of sensations are found to involve psycho-physical reflection.

2. *Intensity of Sensation.* By JAMES E. LOUGH, of Harvard University.

Sensations forming an intensity series have this characteristic which distinguishes them from a qualitative series, namely, that the intensity series goes towards or from

zero—the vanishing point—while a purely qualitative change leads neither to or from the zero point of sensations. Theories of intensity of sensations may be classed in general under two heads: (*a*) that the stronger sensation *is* the weaker sensation plus more of the same sensation—following an analogy from the physical world which may prove dangerous, and exposing psychology to the troublesome presupposition that our psychic elements (sensations) are compounds; (*b*) that the intensity series is merely a qualitative series, but ordered in a series towards or from zero by the presence of a second series of sensations, *e. g.*, brightness sensations or muscular sensations. It would seem much more satisfactory to discover in the nature of the psycho-physical process itself that which shall give to sensations the characteristic of an intensity series. Accordingly this hypothesis is offered: Any sensation of a given quality and intensity that may arise depends upon a certain physiological condition which is reached only after passing successively through a series of other physiological conditions, each of which is but differing in degree from zero to the given sensation. That is, any sensation depends upon the physiological basis which contains, in a temporal series, the bases of all the weaker sensations of this particular quality. The final neural condition, after passing through all the intermediate steps, may be called the 'maximum effect' of the stimulus. By a study of the intensity of sensations produced by a stimulus of a known intensity acting for a time less than that necessary to produce its maximum effect, it is found that this intensity is exactly proportional to the duration of the stimulation. Concerning the nature of the psycho-physical process, nothing is postulated save that the basis of the stronger sensation contains that of the weaker in the time series as stated above.

3. *Report of Experiments on the Reduction of the Tactual Double-Point Threshold by Practice and on the 'Vexirfehler.'* By G. A. Tawney, of Beloit University.

The first object of the experiments was to examine the view of Volkmann and Fechner that, by daily practicing some one spot of skin in the perception of two points, the threshold for this perception is reduced, not only for the spot actually practiced, but also for the symmetrically opposite spot on the other side of the body. A number of threshold determinations were made on different parts of the body varying in number from six to thirty-two for each subject. One of these spots was chosen for special practice, which continued for a period varying from two weeks to a month. At the end of this time the threshold determinations on the six to thirty-two different parts of the body were repeated in order to compare them with those made at the beginning of the practice series. The instrument used was a simple pair of compasses. The results show unmistakably that where any reduction of the threshold occurs as a result of practice it occurs over the entire surface of the body; it demands, therefore, a central explanation. The paper further discussed the nature of the 'Vexirfehler' (double-point illusion). It was assumed that the double-point illusion is the result of suggestion and it was sought to free a subject whose threshold formerly could not be determined from the suggestion involved. The experiments seemed to show that the reduction of the threshold by practice is, to a great extent at least, a result of suggestion. Several series were carried out for the purpose of studying the psychosis underlying the 'Vexirfehler.' The results seem to show that this illusion is mainly due to auto-suggestion, although physiological factors may play a subordinate part.

4. *Comparison of the Times of Simple Reactions*

and of Free-Arm Movements in Different Classes of persons. By ALBERT L. LEWIS.

This paper gave the results of nearly 9,000 experiments on American men and women and on male negroes and Indians. The relative order of these four classes in reacting to sound was found to be arranged from shortest to longest, Indians, American men, Negroes and American women; to light; American men, Indians, American women, Negroes; to touch; Indians and American men the same, Negroes third, American women fourth. With regard to the mean variations of the average reaction times, the order was: in sound; American men, Indians, American women; in light, American men, Indians, Negroes, American women; in touch; Indians, American men, American women, Negroes. The conclusion is drawn that there are characteristic variations in the reaction time and rate of movement of classes of persons; that a close relation exists between reaction time and rate of movement; that a number of reactions is necessary to give a characteristic result in each individual case.

5. *Researches in Progress in the Psychological Laboratory of Columbia University.* By J. MCKEEN CATTELL.

Among the subjects in course of investigation the following were mentioned as likely to be completed soon. Mr. W. Lay, lately Fellow in Philosophy, has, for several years, been studying mental imagery by various methods. In addition to questions such as those proposed by Mr. Galton, others have been set more independent of immediate introspection and extending to auditory and motor imagery. Among others, including musicians, 100 leading artists have, in letters and interviews, described their imagery. Imagery has been investigated by its effects on memory, and in the compositions of poets and other writers. Mr. Lay has, finally, given special attention to his own imagery and associations. Mr. S. I. Franz, Fellow in Psychology, is investigating after-images. He has already published experiments on the threshold for after-images, and is now studying the duration and nature of the after-image as dependent on the intensity, duration and area of stimulation. He is able to correlate the effects of these magnitudes for consciousness and to analyze physiological and mental factors. The individual differences are of interest, for, with the same stimulus, the image differs greatly with different persons. Mr. L. B. McWhood, Fellow in Psychology, is studying the motor accompaniments of the perception and emotional results of music. The movements are a series of taps made as rapidly as possible and a pressure not a maximum, but kept as nearly as may be constant. The subject decides on his preferences, etc., for the tones and combinations used, and these are compared with the motor effects. Mr. H. E. Houston, Scholar in Psychology, is studying color nomenclature with special reference to children. The growth in accuracy and extent of the color vocabulary in schools has been determined, and the attempt will be made to find and set a normal nomenclature for colors and other classes of sensations. Other researches were mentioned but not described.

6. *The Psychic Development of Young Animals and its Somatic Correlation with special reference to the Brain.* By WESLEY MILLS, McGill University, Montreal.

This paper was based on researches on psychic development and on the development of the cerebral cortex in the same groups of animals. As somatic correlation other than that of the brain has been considered in other papers, this phase of the subject was not especially treated in this paper. The main conclusions are as fol-

lows: In the dog and the cat there is a period extending from birth to about the time of the opening of the eyes characterized by reflex movements, the sway of instincts and the absence of intelligence. The advance in movement, first of the limbs and later of the head and face parts, together with the psychic progress associated with this, is correlated with rapid development of the cortical centers for the limbs in the first instance, and later for the head and face in the period immediately following the blind stage. This is more rapid and more pronounced in the cat than in the dog, and is correlated with greater control in the cat over the forelimbs and with certain physiological and psychic developments characteristic of the cat; similar observations were made upon rabbits and cavies. The psychic manifestations of the pigeon and fowl have not the same sort of cerebral cortical correlates as the animals referred to above.

7. *The Organization of Practical Work in Psychology.* By Lightner Witmer, of the University of Pennsylvania.

Under the designation of practical work in psychology was included: (1) The direct application, whether by professional psychologists, practicing physicians or teachers, of psychological principles to therapeutics and to education. (2) Such psycho-physical investigation of mental conditions and processes as may serve to throw light upon the problems that confront humanity in the practice of medicine or teaching. (3) The offering of instruction in psychology to the students of medicine or to teachers that contains a promise of future usefulness to them in their respective professions. Thus the plan has a view to the professional practice of psychology, to research and to instruction as these stand related to the two professions of medicine and teaching. In order that psychology may become a useful possession of the medical man, details of organization must be perfected that will bring about a union of the department of psychology with the professional departments of the medical school. Professor Witmer then went on to suggest details of organization as part of a plan for the development of research work and instruction useful to the community and to the teacher.

8. *Psycho-physical Tests on Normal School and Kindergarten Pupils.* By Miss Mary P. Harmon.

These tests form part of a general scheme which proposes the development of a series of tests which shall be applicable alike to the oldest and youngest pupils in all grades from the kindergarten to the normal school. The intention is to repeat, from year to year, a series of experiments of which a few are included in this preliminary report, as the children now in the kindergarten pass through the various grades. The tests reported upon included family statistics, age, height, weight, lung capacity, simple reaction time to sound and rate of free-arm movement.

9. *Personal Experiences under Ether.* By Wesley Mills, of McGill University, Montreal.

This paper related the experiences of the writer during and immediately subsequent to the adminstration of ether, together with a later experience that seemed to produce a profound impression.

Brother Chrysostom, of the Manhattan College, presented an informal paper, entitled *A Preliminary Study of Memory;* and Professor E. C. Sanford, of Clark University, gave a *Demonstration of an Eye Plethysmograph.*

A paper by Mrs. C. Ladd Franklin, on *Color Blindness and Willem Pole: A Study in Logic,* was read by title.

The titles of the philosophical papers

read on Wednesday morning were as follows :

1. *Philosophy in the American Colleges.* A. C. ARMSTRONG JR., Wesleyan University.
2. *Tests of Current Theory Touching Mind and Body.* DICKINSON S. MILLER, Bryn Mawr College.
3. *The Relation of Mind and Body.* C. A. STRONG, Columbia University.
4. *Is the 'Transcendental Ego' an Unmeaning Conception?* J. E. CREIGHTON, Cornell University.
5. *The Relation of Pessimism to Ultimate Philosophy.* F. C. S. SCHILLER, Cornell University.
6. *The Standpoint and Method of Ethics.* JAMES SETH, Cornell University.
7. *A Generalization of Immediate Inferences.* J. G. HIBBEN, Princeton University.
8. *The Negative in Logic.* A. T. ORMOND, Princeton University.

The afternoon session on the 30th was opened by the address of the President, Professor Fullerton, of the University of Pennsylvania, entitled *The 'Knower' in Psychology.* It was an examination of the nature of knowledge from the standpoint of the psychologist, and the criticism of the 'self' in its knowing function, as it is familiar to readers of philosophy and psychology. Professor Fullerton criticised the Neo-Hegelian doctrine of the '*self*' as a unifying activity in consciousness, and also the view of the self that regards it as a noumenon or metaphysical entity lying behind consciousness and accounting for it. The positive views advanced by the speaker were as follows: The idea that there must be a self distinct from the contents of consciousness to explain consciousness arises out of a mere misconception, and is to be regarded as a survival from an unreflective past. The primary uncritical notion of the self identifies it with the body. In animism we have a duplicate of the body regarded as the self, the knower and doer. In the history of philosophy this notion is made more abstract and unintelligible with the progress of reflection, and in successive systems the function of the self as knower becomes more and more unmeaning. But knowledge is a psychosis like any other psychosis, and it is the duty of the psychologist to analyze and describe it. He must, moreover, use the same psychological method which he uses in treating of sensations or of any other mental elements, and must not try to find an explanation of knowledge by having recourse to a something which lies beyond the realm of psychology as science.

Following the President's address there was held a business meeting of the Association, and a report from the Committee on Physical and Mental Tests, appointed the year before, was presented and accepted. This report is reproduced, as the elaboration of such tests is a matter that concerns several sciences.

PRELIMINARY REPORT OF THE COMMITTEE ON PHYSICAL AND MENTAL TESTS.

The Committee on Physical and Mental Tests appointed at the last annual meeting of this Association submits the following report:

The committee has drawn up a series of physical and mental tests which is regarded as especially appropriate for college students tested in a psychological laboratory. The same series would also be suitable for the general public and, with some omissions and slight modifications, for school children. The committee has had in view a series of tests requiring not more than one hour for the record of one subject. In selecting the tests and methods the committee regarded as most important those which seemed likely to reveal individual differences and development, but also took into account ease and quickness in making the tests and in interpreting and collating the results.

Each member of the committee selected a complete series of tests. The report includes these selections, together with brief descriptions of methods. After each test and method are placed the initials of the members of the committee recommending it.*

Preliminary Data: B. C. J. S. W.

Date of birth; birthplace; birthplace of father; birthplace of mother; occupation (including class in college, or, if not a student, the last educational institution attended); occupation of father; any measurements previously made. B. C. J. S. W.

Color of eyes; color of hair; right or left-handed. B. C. J. S.

Mother's maiden name; number of brothers; sisters; order of birth; age of parents at birth; birthplace and occupation of grandparents. W.

Two schedules of observations and records to be filled in, one by the recorder and one by the subject, as in the Columbia tests, with such modifications as experience shall make desirable. C.

A blank to be filled in by the recorder, noting asymmetry of head or body, color of eyes and hair, complexion, degenerative or other stigmata of head, eyes, ears, mouth, teeth, hands or feet, posture, gait, manner, coordination and speech, indications of intellectual, emotional and moral characteristics. W.

Physical Measurements: C. J. S. B. W.

Height, weight and size of head. C. J. S. B. W.

Breathing capacity. C. J. S. W.

Height sitting. C. W.

*We refer especially to two publications for descriptions of some of the tests: *Official Catalogue of Exhibits*, Department M., World's Columbian Exposition; *Section of Psychology*, Joseph Jastrow in charge, 1893; and Physical and Mental Measurements of the Students of Columbia University, J. McKeen Cattell and Livingston Farrand, *Psychological Review*, Nov., 1896. The following papers on the subject may also be mentioned: 'Mental Tests and Measurements,' J. McK. Cattell, with an appendix by Francis Galton, *Mind*, 1890; Zur Individual Psychologie, Hugo Münsterberg, *Centralblatt f. Nervenheilkunde und Psychiatrie*, 1891. Researches on the Mental and Physical Development of School Children, J. A. Gilbert, *Studies from the Yale Laboratory*, 1895; reported also by E. W. Scripture, *Zeitschrift f. Psychologie*, etc., X., 1896, and *The Psychological Review*, III., 1896; Der Psychologische Versuch in der Psychiatrie, Emil Kraepelin, *Psychologische Arbeiten*, 1895; La Psychologie Individuelle, A. Binet et V. Henri, *L'Année psychologique*, 1896.

The measurements should be made in the metric system. The weight should be taken in ordinary indoor clothing. The height should have the height of the heel subtracted. At least the length and breadth of the head should be measured. B. C. S.

Keenness of Vision: B. C. J. S. W.

The maximum distance at which diamond (4½ point) numerals can be read with each eye singly. B. C. J. S.

The illumination should be in the neighborhood of 100 candle-meters; about eight out of ten numerals should be read correctly at the rate of about 2 per second. The minimum distance should also be determined, if possible. B. C.

In addition or as a substitute, drawing a series of forms as recommended. J.

Use Snellen Test-types. S.

Some other substitute for these tests, to be suggested after satisfactory trial. W.

Color Vision: B. C. J. S. W.

Select as quickly as possible four greens from a series of wools; measure the time; if long, make further tests. C.

Combine with test of rate of perception by requiring subject to name, as rapidly as possible, a series of colors, either wools or papers. B. W.

Use the chart exhibited at the World's Fair. J.

Keenness of Hearing: B. C. J. S. W.

The distance at which a continuous sound can be heard with each ear singly. C. B. W.

Use some artificial external meatus if the test is to show small differences in sensibility. W.

The sound should be from a watch reduced to a standard. An arrangement should be used, by which it can be periodically cut off without the knowledge of the subject. C. S. B.

Use for this a stop-watch. J. S.

I endorse the stop-watch; it can be manipulated, so that the time is recorded, showing how long it took the subject to decide that the watch has stopped. J.

Perception of Pitch: B. C. J. S.

Adjust one monochord or pipe to another, the tones not to be sounded simultaneously. C. J.

Select a match from a set of forks, making a fixed number of vibrations per second more or less than a standard, *e. g.*, standard 500 v. per second; other forks, 497, 497.5, 498, 498.5, etc.; 500, 500.5, 501, etc. B. S.

I prefer the adjustment to the selection method. The test can be made with two Gilbert tone-testers. J.

Fineness of Touch: C. J. S. W.

The æsthesiometer is unsatisfactory; the discrim-

ination of roughness of surfaces and touching a spot previously touched should be tried. C. J. W.

Sensitiveness to Pain: B. C. J. S. W.

The gradually increasing pressure that will just cause pain. The point or points in the body to be used to be agreed upon. B. C. J. W.

Perception of Weight or of Force of Movement: B. C. J. S. W.

Arrange a series of weights. B. J. W.

Make movements of equal force and determine the error. C.

The best method still to be developed. J.

Dynameter Pressure of Right and Left Hands: B. C. J. S. W.

Dynamometer. B.

In place of or in addition to the ordinary dynamometer test make movements of the thumb and forefinger and continue as rapidly as possible for fifteen seconds. C.

Use mechanical counter for this and take reading at end of every minute. S.

Thumb and finger dynamometer. Record best and worst of five trials. W.

Rate of Movement: W.

Distance of 35 cm. One preliminary trial with right hand in extension, then two trials in succession of R. E., L. F., L. E., R. F. Collate shortest of two trials under each typical movement. W.

Fatigue: B. C. W.

Muscular exertion. B. W. As described above. C.

Intellectual exertion. B. W.

Will Power: W.

The ability of the subject to respond after fatigue has set in to a suggestion of the experimenter with an extra effort of will. W.

Voluntary Attention:

Test by simple mental operations under distraction. B.

Coincident variations in Psycho-physical process. W.

The modifiability of the knee jerk, or of a sustained bodily process, such as rate of breathing or pulsation of a volitional muscular or intellectual process, when the subject's attention is engaged by some mental content. W.

Measure at the same time concentration or distraction of attention. W.

Right and Left Movements: J. W.

The accuracy with which movements are made to the right and left. J. W.

Some such test as this for indication of right and left-handedness. W.

I do not insist on this test as one of great importance. J.

Rapidity of Movements: C. J. S. W.

Taps on a telegraph key. J. W.

Movements requiring force, as described above. C.

Make short marks as rapidly as possible for twenty or thirty seconds, *e. g.*, | | | | |. S.

Trilling with two fingers and with five. W.

Accuracy of Aim: B. J. S. W.

Throwing a marble at a target. J.

Or striking a point upon the table with a pencil point. W.

Touch an insulated spot, as proposed by Scripture. S. B. Also for steadiness of hand. B.

Reaction-time on Sound: B. C. J. S. W.

The reaction to be made with the right hand with a signal about two seconds before the stimulus. B. C. J. W.

Five reactions to be made without preliminary practice; after the reactions have been made, the observer to be asked whether the direction of the attention was motor or sensory. B. C.

It is not much use to ask for direction of attention with most subjects. W.

Sensory and motor reaction with instruction, after the above test. B.

Reaction-time with Choice: B. J. W.

Use card sorting. B. J. S.

Rate of Discrimination and Movement: B. C. J. S. W.

100 A's in 500 letters to be marked or as many as can be marked in one minute. B. C.

One out of a number of geometrical forms to be marked: determine the number marked in 90 seconds. J. W.

Or colors, or pictures of objects. W.

Quickness of Distinction and Movement: B. J. S.

Rate at which cards are sorted. B. J. S.

Combine with reaction with choice. B.

With the effects of practice, etc., as proposed by Bergstrom. S.

Perception of Size: C. J. S. W.

Draw a line equal to a model line 5 cm. in length, bisect it, erect a perpendicular of the same length and bisect the right-hand angle. C. J.

Perception of Time: B. C. J. S. W.

The accuracy with which a standard interval of time, say ten or twenty seconds, can be reproduced. C. W.

Thirty seconds or one minute. W.

Memory: B. C. J. S. W.

The accuracy with which eight numerals heard once can be reproduced and the accuracy with which a line drawn by the observer at the beginning of the hour can be reproduced at the end of the hour. C. W.

Line to be identified. Ten numerals to be used. B.

Nine numerals. S.

A combined test of memory, association and finding-time as described in the catalogue of the Columbian Exposition. J. W.

Accuracy of observation and recollection as proposed by Cattell and by Bolton. J. W.

Memory-type: B.

Variations in use of 10 numerals; method as follows:

1. Show numerals in chance order and have subject write them from memory after an interval.

. Speak numerals in chance order and have subject write them from memory after an interval.

. Show and speak in chance order and have subject write them from memory after an interval.

4. Show and have the subject speak them and then write them from memory after an interval.

Compare the results for indications of memory type and kind of imagery preferred. Question the subject as to his mental material in each case. B.

Apperception test of Ebbinghaus. B.

Imagery: B. C. J. S. W.

Questions proposed in the Columbia tests. C.

Methods should be worked out more fully. C. J. W. B.

Cf. Method under preceding head. B.

Make memory span tests, showing and speaking the digits at the same time, and ask the subject which sense (sight or hearing) he found himself using, and if either seemed to him a distraction. S.

The committee urges that such tests be made, so far as possible, in all psychological laboratories. It does not recommend that the same tests be made everywhere, but, on the contrary, advises that, at the present time, a variety of tests be tried, so that the best ones may be determined. Those who make tests which they regard as desirable are requested to send these with sufficient descriptions to the committee.

The committee hopes that the tests proposed may be discussed fully at the present meeting of the Association, and asks that the present committee be continued for another year.

(Signed,)
J. Mark Baldwin,
Joseph Jastrow,
E. C. Sanford,
Lightner Witmer,
J. McKeen Cattell, *Chairman.*

At the business session the following officers were elected: President, Professor J. Mark Baldwin, of Princeton University; Secretary and Treasurer, Dr. Livingston Farrand, of Columbia University; new members of the Council, Professor Josiah Royce, of Harvard University; Professor Joseph Jastrow, of the University of Wisconsin. The following new members were elected: Professor G. H. Palmer, Harvard University; Professor J. G. Hibben, Princeton University; Professor R. B. Johnson, Miami University; Professor F. C. French, Vassar College; Dr. E. F. Buchner, Yale University; Dr. Ernest Albee, Cornell University; Dr. C. H. Judd, Wesleyan University; Dr. Alice J. Hamlin, Mt. Holyoke College; Dr. G. A. Tawney, Beloit University; Mr. F. C. S. Schiller, Cornell University; Dr. C. W. Hodge, Princeton University; Mr. J. F. Crawford, Princeton University; Dr. C. F. Bakewell, Harvard University; Dr. David Irons, University of Vermont; Dr. Robert McDougall, Western Reserve Uuiversity; Mr. A. F. Buck, Union College.

An invitation was received from the British Association for the Advancement of Science to attend the next annual meeting to be held at Toronto, Canada, as members of the Section of Physiology. Upon the recommendation of the Council, it was moved and carried that such members of the Council as are able to attend be official delegates of the Association to the meeting and that such members of the Association as may be able, accept the invitation to attend

as members. An invitation was also received from the American Association for the Advancement of Science to join that Association. The Council recommended that all members who might feel so disposed present their names for election to that Association.

The time and place of the next meeting of the Association was left to the President to be decided in consultation with the Presidents of the affiliated societies.

After a vote of thanks for the hospitality extended to the Association the meeting adjourned.

LIVINGSTON FARRAND,
Secretary.

COLUMBIA UNIVERSITY.

THE AMERICAN FOLK-LORE SOCIETY.

THE eighth annual meeting of the American Folk-lore Society was held at Columbia University on December 29th.

During the past year the Society has lost two of its most esteemed members—its President, Capt. John G. Bourke, and Professor Francis J. Child, one of its founders and its first President.

The Society elected Professor Sidney A. Hartland and Dr. H. Steinthal honorary members.

The officers elected for 1897 were as follows:

President, Mr. Stewart Culin, of the University of Pennsylvania; 1st Vice-President, Dr. Henry Wood, of Johns Hopkins University; 2d Vice-President, Dr. Franz Boas, of Columbia University; Permanent Secretary, Mr. W. W. Newell, Cambridge, Mass; Treasurer, Dr. John H. Hinton, of New York City.

To facilitate closer cooperation with other scientific societies and to afford individuals greater opportunities to receive benefit from kindred organizations, the Permanent Secretary was authorized to arrange the time and place of the annual meeting and was instructed to give preference to the time and place of meetings of the American Psychologists and Society of Naturalists. The Permanent Secretary was further authorized to call a summer meeting at the time and place of the meeting of the American Association for the Advancement of Science.

The Society has recently published a volume of Current Superstitions, by Mrs. Fanny D. Bergen, and it has now in press a volume entitled Navaho Legends, by Dr. Washington Matthews.

A full programme of papers was presented, of which only a part can be here mentioned.

Miss Alice C. Fletcher's 'Notes on Certain Early Forms of Ceremonial Expression' developed the idea that among savage peoples the burden of the song is, to a greater extent than heretofore recognized, correlated with the emotion which the song is desired to express. Miss Fletcher has investigated this subject specially among the Omahas, and her studies in this direction are still in progress. Incidentally, the accuracy of repetition and pure preservation of native songs was mentioned; an example being an Omaha song, recorded by means of the phonograph, which agreed in every detail with the same song as collected twelve years prior.

'Ceremonial Hair-Cutting among the Omahas' was treated by the same speaker. The hair has been associated with strength in the lore of many peoples and has been treated as of close connection with the life and reality of the individual. Thus some peoples when giving a name and thus adding an important part to the personality of an individual think it necessary to counterbalance this act by cutting off a portion of the hair.

Mr. W. W. Newell's paper on 'The Legend of the Holy Grail' was intended to suggest that literary productions, under certain circumstances, may develop into folk-tales.

Dr. Robert M. Lawrence spoke of the many superstitions connected with common salt even among our own people.

Mr. Stewart Culin exhibited a number of Divinatory Diagrams from Tibet, China, Mexico, etc., and called attention to their similarity as well as to the fact that they, being arranged on a plan of four quarters, might be developed from the idea of the four cardinal points.

'An Ojibwa Myth,' by Harlan I. Smith, referred to the white-dog sacrifice and ideas common to several of the neighboring tribes.

'The Psychic Origin of Myth,' by Dr. D. G. Brinton, was an inquiry into how far the psychic unity of man satisfactorily accounts for similarities in myths found among widely separated peoples. Dr. Brinton's position that it accounted for even minor details was vigorously contested by several present.

Mr. Stansbury Hagar contributed from his store of Micmac mythology such parts as related to weather and the seasons.

Miss Whitney, Secretary of the Baltimore Branch of the Society, contributed a paper on the lore of 'The Sword and Belt of Orion or De Los Ell an Yard.' It seems that this group of stars in the constellation of Orion holds an important place in the folk-lore of the negroes.

Dr. Franz Boas related 'A Star Legend from the Interior of Alaska and its Analogues from the other parts of America.' While holding to the idea generally accepted among scientists, that the same fundamental concept may arise independently among widely separated peoples having no contact, and due purely to the same psychic phenomena common to man; yet he held that similarity in a long series of minor details, especially in cases where contact was possible, could not be positively accounted for in that way and that historic influence must be considered as well as psychic unity.

Mr. W. S. Scarborrough's paper on 'Negro Songs' was an interesting contribution on the play songs of negro children.

'The True Story of Blue Beard,' by Professor Thomas Wilson, illustrated the making of folk-lore, the changing of a historic story to a legend by continual repeating with slight change, in a way exactly opposite to the accurate repetition of the Omaha song.

A public lecture was given in the evening by Mr. Heli Chatelain, on 'African Life Illustrated.' Mr. Chatelain, who was late United States Commercial Agent in Angola, spoke very feelingly against the existing Arab slave trade, while his main subject was the ethnology of the Negroes of Angola, from whom he collected the volume of folk-tales recently published by the Society.

The meeting concluded with the annual dinner. In this the Society was joined by the Section of Anthropology of the American Association for the Advancement of Science, with which it is closely affiliated.

Harlan I. Smith.
American Museum of Natural History.

HORATIO HALE.

In the death of Mr. Horatio Hale, which took place at Clinton, Ontario, December 28th, science in America has lost an earnest worker and student, who for more than half a century has been prominent in linguistic and ethnographic literature. Indeed, it is sixty-three years since his first contribution to science was printed—a small pamphlet on an Algonquian dialect. He was born May 3, 1817, at Newport, N. H., and was at the time of that publication a student in Harvard College.

He graduated in 1837 and was immediately appointed as 'philologist and ethnographer' to the United States exploring expedition under Captain Charles Wilkes. His report constituted the seventh volume

of the series published by the expedition and makes a stately volume of 666 pages. It is filled with extremely valuable material relating to the ethnology and dialects of the various tribes encountered by the expedition, especially in Patagonia, Polynesia, Australia, South Africa and the northwest coast of North America. The grammar and comparative vocabulary of the Polynesian dialects are especially creditable, and Mr. Hale's studies of the migrations of the Polynesians and the peopling of the islands of the Pacific ocean may be justly said to have laid the foundation for all subsequent researches in that field. In their main outlines they have stood the test of later inquiry, and are accepted to-day by the soundest anthropologists.

Ten years after the publication of this volume (1846–1856), he removed to Clinton, Ontario, Canada, where he resided the remainder of his life, practicing law, but always in touch with the progress of his favorite scientific studies. His contributions to these, though not very numerous, were ever marked by an intimate knowledge of facts and deep and original reflection.

One of the most important of his works was the translation and editing of 'The Iroquois Book of Rites,' forming the second volume (pp. 222) of the 'Library of Aboriginal American Literature.' This valuable native document was printed in the original text, with a learned introduction and notes.

Mr. Hale was the first to discover the presence of the Siouan stock on the Atlantic coast by identifying the Tutelo of Virginia as a dialect of the Dakotan family. In two essays, one on 'The Origin of Languages' and the other on 'The Development of Language' (1886 and 1888), he brought forward and ably supported a reasonable and probable theory for the rise and extension of independent linguistic stocks, many of which are often found in limited areas. It is enough to say of these papers that their argument is masterly and that no other theory more acceptable has yet been presented to the scientific world.

In a later essay (1893), on 'Language as a Test of Mental Capacity,' he defended the value of linguistics as a criterion for ethnic classification; though in the development of this argument, he was somewhat hampered by his opinions as to the relations of savage to civilized conditions. In the same year a paper by him, on 'The Fall of Hochelaga,' set forth for the first time the early history of the Huron-Iroquois tribes.

Mr. Hale was an active member of the American and British Associations for the Advancement of Science, and was one of the founders of the Anthropological Sections in both. In 1886 he was Vice-President of the former and Chairman of the Section on Anthropology. He was also a President of the American Folk-lore Society, and an honorary or corresponding member of many learned associations.

In his village home he was constantly active in educational plans and in those tending to the development of the best interests of the community. Personally he was affable and considerate, and in the warmth of scientific discussions never forgot the courtesies of life, several times in this respect setting a much-needed example to his opponents.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

EMIL DU BOIS-REYMOND.

EMIL DU BOIS-REYMOND, the eminent physiologist and philosopher, died in Berlin on December 26, 1896, at the age of 78. He was the last of those four bright stars which illuminated the horizon of natural sciences for more than half a century. They are all gone now. Brücke died first (1892); then Helmholtz (1894); then Carl

Ludwig; and now du Bois-Reymond, last but not least, has passed away. These four eminent men who made everlasting marks in science have been life-long friends. All four were pupils of that grand master Johannes Müller. All four started out on their phenomenal scientific careers in the beginning of the forties and, though each one worked in a different line of research, they all had one object in common, which was paramount to them, and that was the liberation of the biological sciences from the deadening grasp of the obscure natural philosophy of those days, and the building up of physiology on a scientific rational basis. In combating the paralyzing idea of a 'vital force,' none was as energetic, none as perseverant as du Bois-Reymond. Only recently the old warrior in service of rational science again entered the arena to fight the old enemy in disguise, the 'neovitalism' of a Bunge, a Rindfleisch and others. Du Bois-Reymond and the other great physiologists are no more, and there is at present no one to fill their places. Who will protect physiology against the onward course of these new 'vital forces.'

E. du Bois-Reymond was born on November 7, 1818, in Berlin. He received there his general education at the College Français, and in 1837 he entered the University of Berlin, where he registered at first in the philosophical faculty, attending various lectures on philosophy, history and even theology. An accidental attendance at one of the lectures of Mitscherlich on experimental chemistry, however, had a deciding influence upon du Bois-Reymond's future. He began to study mathematics and the natural sciences, and went over later to the study of medicine, thus coming in contact with Johannes Müller, who was at that time the professor of physiology and anatomy at the University of Berlin. Du Bois-Reymond became first the 'famulus,' and later on the assistant, of Johannes Müller. In 1846 he established himself as 'privat-docent' at the University, and in 1855 he was made 'professor extraordinarius.' In 1858, after Müller's death, the chair of physiology was separated from that of anatomy, and du Bois-Reymond was made professor of physiology and director of the physiological laboratory in the University of Berlin, a position which he held to the last day of his life. In 1851, at the proposition of Alexander von Humboldt and Johannes Müller, du Bois-Reymond was elected to the *Berliner Academie der Wissenschaft*, a very high honor for a young man of only 33 years, and since 1867 he was the permanent secretary of the academy. Du Bois-Reymond was an honorary member of numerous scientific societies all over the Old and the New World.

The brilliant scientific carer of du Bois-Reymond was again determined by a single accident. In 1841 Johannes Müller handed to his amanuensis Matteucci's paper (Essai sur les phénomènes électriques des Animaux, Paris, 1841) for the verification of the experiments on the so-called frog current of Nobili. It became the task of du Bois-Reymond's life, and he solved it by creating a new science, the science of animal electricity. Already, a year later, appeared his first short paper on this subject (Ueber den sogenannten Froschstrom und die electromotorischen Fische, Poggendorff's Analen der Physik, Vol. 58), and was followed by his thesis (Quæ apud veteres de piscibus electricis extant argumenta, 1843). Then years of silence followed, years of hard labor, of seclusion in his small private laboratory, where 'the frog and the multiplicator were the whole world' to that most energetic of all investigators. The problems, the methods, the instruments, were thoroughly worked out with unparalled energy, ingenuity, precision and self-criticism, before they were communicated to the world. But then, when his book on animal electricity came out, it was a revelation, it marked an

epoch in physiology. In 1848 appeared the first volume of that book, 'Untersuchungen ueber thierische Elektricität.' In 1849 followed the first part, and in 1860 the second part, of the second volume. It was not simply a communication of new striking facts and new methods; it was an exhaustive statement of the creation and completion of a new science, presented in a brilliant style and in a language unusually clear and full of life and force. His later contributions to the physics of nerve and muscle appeared mostly in the reports of the Berlin Academy of Sciences, or in the Archiv für Physiologie, of which du Bois-Reymond was the editor. Among the fundamental facts which were added by du Bois-Reymond to physiology we have to mention, in first place, the establishment and development of the laws of the muscle current, the discovery of the nerve current, the discovery of the so-called negative variations in muscle and in nerve, the discovery of the electrotonus, etc., etc. Du Bois-Reymond has devised and invented numerous important scientific apparatus, many of which are to be found in all well-equipped physiological laboratories; for instance, the induction coil, the electric key, the non-polarizable electrodes, etc., etc. Du Bois-Reymond's name will live forever in the science of physiology.

Aside from his special scientific work, we should not omit to mention the public speeches (Reden) delivered by du Bois-Reymond on many special occasions. In those speeches, as a rule, an important subject was treated in a classical style. They were models of clearness and brilliancy, and nearly every one of his speeches has been an event in its time, and many of them have been translated into all civilized languages. We need only to mention here the following: 'Darwin *versus* Galiani,' 'Die Lebenskraft,' 'Ueber die Grenzen des Naturerkennens,' with his *ignorabimus*, and 'Die Sieben Welträthsel.' He was as forcible a speaker as a writer. And both his pen and his speech have been employed only for a fearless propagation of high ideals and in defence of the rational principles underlying modern sciences.

His last work was one of love. Shortly before he died he finished reading the proofs of his carefully prepared memorial of his friend Helmholtz.

S. J. MELTZER.

CURRENT NOTES ON METEOROLOGY.

THE PLAGUE AND CLIMATIC CONDITIONS.

THE present outbreak of the plague in India suggests certain considerations with reference to the possible connection of its occurrence with climatic conditions. While it used to be thought that the plague could not occur in the Torrid Zone, it is now known, in view of outbreaks of the disease within the tropics in Arabia and India, that this rule does not hold rigidly. In Egypt the autumn seems to be the season in which the plague appears, and June the month in which it dies out. In Europe, outside of Turkey, the plague season has been summer and autumn. In India no direct connection with the seasons could be detected in the epidemics of 1815–21, the first outbreak concerning which we have trustworthy information, and of 1836–38. From all the data at hand, the general conclusion is that a moderately high temperature favors the development and extension of the plague, but extremes of heat and cold are unfavorable to its breaking out. Exceptions to this rule are many. For instance, in the epidemic at Smyrna in 1735 the heat was so excessive during the plague that many of the people who left the town for neighboring villages died of sunstroke on the way, while in Roumelia, in 1737–38, the plague continued in many places in which the temperature fell at times to 3° Fahr. Regarding the effect of atmospheric mois-

ture there is also some doubt. Some authorities hold that a high degree of humidity is necessary for the epidemic extension of the plague, while others maintain the opposite view. Certainly the occurrence of many outbreaks at high altitudes in Kurdistan, Arabia, China and India makes it clear that a moist atmosphere is not always an essential in the spread of the epidemic. The present outbreak in India, coming at a time when medical men in that country and all over the world are thoroughly alive to the importance of studying the climatic relations of the disease, will undoubtedly result in giving us much additional information in this connection. The occurrence of this outbreak in India at a time of famine recalls the fact that the plague 1815–21 broke out in the island of Cutch in a district where there had been a famine a short time before.

CHINOOK WINDS IN THE NORTHWEST.

The conditions under which chinook winds occur in the Northwestern States is well illustrated on the Portland, Ore., weather map for December 3d, last. At 5 a. m., Pacific time, on that day an area of low pressure was central over the ocean northwest of Washington, extending over British Columbia and northern Washington, while an anticyclone was central near Salt Lake City. This distribution of pressure naturally resulted in a flow of air from the south and southwest over the States of Washington, Oregon, Idaho and Montana. The temperatures were from 46° to 50° west of the Cascade mountains, and from 24° to 32° east of them. The effect of the mountain ranges in causing an adiabatic warming of the descending air is well shown in the course of the isotherms of 40° and 50°, which run north and south parallel with the mountains in Washington and Oregon, and in the direction of the 30° isotherm, which turns eastward across northern Idaho, running south of Helena, Mont., where the wind was south and came across the Rockies, and then turning northward east of Havre. Our chinook winds are similar to the well-known foehn winds of Switzerland. In both cases they appear as warm and dry winds, blowing down from mountain ranges, and when they occur in winter have the habit of rapidly evaporating the snow which may be on the ground at the time. In Switzerland this habit has gained for the foehn the characteristic name of *Schneefresser*. In the United States the snow-eating quality of the chinook is well known, and is an extremely important factor in clearing away the snow blockades on railroads and in removing the snow from the stock ranges.

R. DeC. Ward.
Harvard University.

CURRENT NOTES ON ANTHROPOLOGY.

ETHNOLOGIC MEDICINE.

The principles of the general development of the arts applied to medicine is the subject of an article by Dr. J. H. McCormick in the *American Antiquarian* for August last. He points out that in many tribes, geographically remote, at the same stage of culture, similar ideas and methods in reference to the practice of medicine and the power of drugs prevailed. Magical formulas were adopted for the cure of disease, and mysterious and eccentric remedies were in vogue, all quite analogous in like stages of culture everywhere. The conjurations of the ancient Egyptians, *mutatis mutandis*, would pass for those of the Cherokees or Nahuas.

The author draws the just inference that those who assert that such similarities are evidences of historic unity, and that they should be explained by some ancient community of culture, do not correctly apprehend modern psychology. This teaches, as its basic principle, that like conditions lead

to similar trains of thought and those to analogous results.

SACRED SECRET SOCIETIES.

IN *L'Anthropologie* for October there are accounts of two sacred secret societies which illustrate the curious aberrations of religious doctrines, unrestrained by reason.

The society of 'Leopards' exists in Sierra Leone. Their god is represented by a manioc root, stuffed with various holy objects. They are cannibalistic, and the price of initiation is to induce some member of the applicant's family to wander into the midst of the assembly, there to be slain and eaten. The reward is to receive this fetish, which will bring good luck.

The other society, already mentioned by some writers, is that of the Aioi, of Tahiti and some other Polynesian islands. It is composed of both men and women, some belonging to the highest castes. It is devoted to the genesiac cult in its most abnormal forms, and one of its laws is that the members must scrupulously avoid the reproduction of their kind.

The incredibly obscene groups in pottery and metal excavated from the tombs of the Yuncas in Peru can probably be explained by the existence among them of some such religious society.

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NOTES ON INORGANIC CHEMISTRY.

SEVERAL years ago Professor Dunnington, of the University of Virginia, showed that the element titanium was much more widely distributed in nature than had been supposed. Indeed, not only all rock masses, but even all soils, examined by him were found to contain considerable quantities. More recently Professor Charles E. Wait, of the University of Tennessee, has had occasion to analyze the ashes of various vegetable substances for titanium and finds it to be an invariable constituent. The ash of oak contains 0.31 per cent., of apple wood 0.11 per cent., and of cotton-seed meal 0.02 per cent. In coals titanium was found present to the extent of from nearly one per cent. in bituminous coals to over two and a-half per cent. in Pennsylvania anthracite. Titanium thus appears to be one of the most widely distributed elements and it is not improbable that analyses will show that it is also found in animals.

IN the last *Nature* Professor Spencer Pickering comes to the support of Professor Armstrong in his attack upon the theory of electrolytic dissociation of salts in solution. In the course of his article he says: "For a theory to be acceptable it should, at the very least, be reasonably probable, and should not violate any fundamental and well established facts; it should stand the test of any apparently crucial experiments * * * and, I think we may add, it should give some explanation, not simply of the behavior of matter in the condition in question, but also of why matter ever assumes such a condition. The theories of osmotic pressure and ionic dissociation, I believe, have not done this."

THE opening of the Davy-Faraday Research Laboratory in London should mark an epoch in chemical science in Great Britain. This laboratory has been established by Dr. Ludwig Mond at a cost of half a million dollars. $170,000 has been expended in the building and its equipment, while $330,000 remains as an endowment fund. The laboratory is furnished with the most modern instruments and appliances for researches in pure and physical chemistry. In opening the laboratory Dr. Mond said he had named it the Davy-Faraday Research Laboratory, in perpetual memory of those two great pioneers of science who carried out their world-famed and epoch-making researches almost on

that spot, and whose example, he hoped, would stimulate and inspire every one who came to work under that roof. The laboratory is open to persons of either sex and of any nationality who can satisfy the laboratory committee that they are fully qualified to undertake original scientific research in pure or physical chemistry, preference being given to those who have already published original work. The directors of the laboratory are Lord Rayleigh and Professor Dewar.

In the *Comptes Rendus* for December 2d Stanislas Meunier recorded observations on some asphaltic rocks and on the origin of asphalt. From the behavior of bitumenous rocks towards solvents the conclusion is drawn that bitumen is the result of purely mineral reactions, as of the double decomposition of metallic carbids and water.

J. L. H.

ASTRONOMICAL NOTES.

The *Astronomische Nachrichten* of January 4th contains a description by Professor Deichmüller, of a new instrument devised by him for fixing the position of the zenith with a meridian circle. The telescope is pointed approximately at the zenith, and the new instrument is mounted above the object glass. It consists of a circular disc of parallel surfaced glass floating in mercury. The vessel containing the mercury is so shaped that the glass is supported at its edges only, so that it is possible to get an unobstructed view of the sky through the middle portion of the glass. It is thus possible to observe the reflected image of the wires, and then to transfer the position of the zenith to the sky without the use of any graduated circle. The instrument is ingenious, and the principle is novel. Prof. Deichmüller gives some very accordant observations made with it. As in the case of all the floating collimators, however, it will be necessary to make sure that the opposite sides of the mercury do not differ in temperature.

The December Monthly Notices of the Royal Astronomical Society contains an interesting article by Prof. Rambaut, of Dublin, on a method of correcting the rate of an equatorial clock, so as to make the telescope follow very nearly the motion of the stars for the purposes of photography. Professor Rambaut gives formulæ for calculating the effect of refraction upon the apparent rate of diurnal motion of the stars, and shows how this effect can be very nearly compensated by varying the clock rate. In this way the work of the observer can be made much easier.

The Wasburn Observatory of the University of Wisconsin has issued Vol. X., Part I., of its Publications. It contains a series of double-star observations by Professor Geo. C. Comstock.

The director's report of the Harvard College Observatory for the year 1896 has appeared. From it we learn that the new Bruce photographic telescope has been transported to Peru, and successfully mounted at Arequipa.

H. J.

SCIENTIFIC NOTES AND NEWS.

Mr. Charles D. Walcott, the Director of the United States Geological Survey, has been appointed Acting Assistant Secretary of the Smithsonian Institution, with duties confined to the charge of the National Museum. It is understood that Mr. Walcott has not taken the new office permanently and that he does not expect to give his full time to the duties of administration of the affairs of the Museum, these being left largely to the present permanent staff of that institution. He will exercise a general supervision and direction of the affairs of the Museum in addition to his present duties as Director of the Geological Survey. Mr. Walcott is well acquainted with the administration of the National Museum. For the past twelve years he has held the position of Honorary Curator in the Museum and for

eight years had his laboratory as paleontologist of the Geological Survey in the Museum building. The interests of the Museum and of the Geological Survey are very closely connected. Mr. Walcott's selection for this post seems an eminently fitting one in view of the unusual executive abilities which he has shown himself to possess since he assumed the Directorship of the Geological Survey in 1894. Mr. Walcott is a native of New York State and has been connected with the Geological Survey since 1879.

IT is reported in *The British Medical Journal* that the sum received by the Huxley Memorial Committee now amounts to nearly £3,000. Mr. Onslow Ford, R. A., has nearly completed the full-size model of the statue which is to be placed in the central hall of the Museum of Natural History at South Kensington. The dies for the Royal College of Science medal are now being prepared by Mr. L. Bowcher.

THE funeral ceremonies of du Bois-Reymond took place on December 29th in the lecture hall of the physiological laboratory, Berlin. Dr. Bosse, the Prussian Minister of Education, represented the government, and there were delegates from many scientific and learned societies. The Reverend Professor Scholz made the chief address; and other speeches were made by Professors Warburg, Munk, Rosenthal, Fritsch and Pictet.

WE regret to notice the deaths of Dr. Aug. Streng, professor of mineralogy at the University of Giessen; of Professor Saccardo, of the Analino School of Viticulture, Italy, and of Frederic John Mouat, who had made contributions to medical and statistical science.

THE following further corresponding members have been elected to the St. Petersburg Academy: Sophus Lie, professor of mathematics in Leipzig; W. Ostwald, professor of chemistry in Leipzig; M. Landolt, professor of chemistry in Berlin; Karl Zittel, professor of paleontology in Munich.

PROFESSOR PAUL HARZER, director of the observatory near Gotha, Saxony, has been appointed director of the observatory at Kiel and professor of astronomy in the University in the place of the late Professor Krüger.

PROFESSOR VIRCHOW has been reelected President of the Berlin Medical Society.

LEOPOLD VOSS, of Hamburg, announces as in preparation von Helmholtz's *Vorlesungen über theoretische Physik*, edited by Arthur Kōnig, Otto Krigar-Menzel and Carl Runge, to be published in six volumes.

FRANCIS P. HARPER will publish the journals of Alexander Henry the younger and David Thompson, the former a fur trader and the latter a geographer, edited by Dr. Elliott Coues.

SECRETARY MORTON, in his recent report, calls attention to the inadequacy of the salaries paid to higher officials in the Department of Agriculture. The salary of a chief is now $2,500, and that of an assistant $1,800. The Secretary has recommended, in the estimates for the next fiscal year, that the salaries of chiefs of divisions be increased to $3,000 and those of assistant chiefs to $2,000. He calls attention to the fact that on account of the low salaries paid for scientific and skilled services, the Department is constantly losing some of its ablest and best workers. The universities, colleges, and experiment stations, paying better salaries and offering equal opportunities for useful work and the acquirement of national reputation, are frequently taking the best men. Thirty-two leading scientific experts have left the Department during the last few years to take positions in other institutions, at a rate of remuneration averaging fully 50 per cent. more than they received from the government of the United States.

THE reports regarding the bequest of Alfred Nobel have been meager and conflicting. The London *Times* and other journals stated that the fourth prize was for a compilation in physiology or medicine, but the foreign journals now state that this prize is for a work of literary art. The prizes in physics and chemistry will be awarded by the Academy of Sciences of Sweden; the one for work in physiology or medicine by the Carolus Institute of Stockholm; the literary prize by the Swedish Academy, and the one for the furtherance of peace by a committee of five members chosen by the Norwegian Storthing.

WE have published an account of the report of the Committee of the British Asso-

ciation for the Advancement of Science on the establishment of a national physical laboratory. It is reported that the Council of the Association will take steps to bring the matter before the government, and to invite the cooperation of the Royal Society of London, the Royal Society of Edinburgh, the Royal Astronomical Society, the Physical Society, and other cognate associations, in securing the foundation of the laboratory.

Mr. C. G. Pringle, says the *Botanical Gazette*, has returned from his annual trip to the more unknown regions of Mexico with 20,000 specimens.

Dr. Dahl, says *Die Natur*, has sent from Ralum, in the Bismarck Archipelago, a collection made from the fauna and flora of that little-known region to the Museum in Berlin.

There is, it appears, in San Francisco, an incorporated Atlantic and Pacific Aerial Navigation Co., which proposes to build a large airship and has, at all events, purchased from the Pittsburg Reduction Company a quantity of aluminium.

Prometheus, in the issues of January, 1897, is publishing illustrated articles on German industries (*Die Heimstätten der modernen Industrie*), which have considerable interest to our own manufacturers, especially in departments in which exportation is a matter of actual or potential importance.

The estimates of the Russian Minister of Finance include about 64,500,000 roubles for the construction of the Siberian Railway and over 33,500,000 roubles for the construction of other railways. It also appears from the statement of the Minister that the manufactured products of Russia greatly exceed in value those of agriculture.

According to the official report issued on January 28th, there have been 4,396 cases of the plague in Bombay, and 3,275 deaths from that disease. At Kurrachee 694 cases and 644 deaths have been recorded. At Poonah there have been 65 cases and 60 deaths, and a few cases have occurred at Surat, Baroda, Ahmadabad, Kathiawar and Cutch.

According to *Industries* the trials of H. M. S. 'Terrible' has resulted in proving her to be the fastest cruiser afloat. Admirable as were the trials of the 'Powerful,' those of the 'Terrible' are even more satisfactory, a mean speed of no less than 22.41 knots being obtained under very adverse circumstances, the sea being rough and the wind having a velocity of 26 miles an hour, with an indicated horse-power of 25,572. With an indicated horse-power of 25,069 a speed of 22.24 knots was obtained against the wind; with the wind the 23 knots of the course was accomplished in just over the hour, the actual figures obtained being 22.873 knots. The coal consumption, with partially untrained stokers, was 1.71 lb. per indicated horse-power per hour.

The leading article in the current number of *Appleton's Popular Science Monthly* is entitled 'Herbert Spencer, the Man and his Work,' and is by Professor W. H. Hudson, of Stanford University, who was at one time closely associated with Mr. Spencer in his work. Dr. E. L. Youmans and the *Popular Science Monthly* accomplished much to establish Mr. Spencer's reputation, and it is fitting that the completion of the system of Synthetic Philosophy, should be signalized by the publication of this article. The series of articles by Professor W. R. Newbold concludes with one on the interpretation of automatism, and Professor W. Z. Ripley begins a series of articles on the Racial Geography of Europe, which were delivered as Lowell Institute lectures, in 1892. In the first article the relation of language to race and nationality is especially considered. There are also articles by the late Horatio Hale on Indian Wampum Belts; on Some Primitive Californians, by Mary Sheldon Barnes; on How Plants and Animals Spend the Winter, by W. S. Blatchley, and Condemnation of Criminals not Punishment, by Edward F. Brush. There are biographical sketches of W. D. Gunning and Maria Mitchell, both with portraits

According to the present law scientific books and periodicals devoted to scientific research are admitted free of duty. The New York *Medical Record* states that the Treasury Department has recently issued a circular to the Collectors of Customs in which it is said that certain books have been admitted under a too

liberal construction of the law, and the customs officers are notified that the words 'scientific books and periodicals devoted to original scientific research' relate to new discoveries in the field of science, and do not include textbooks, compilations, and discussions of scientific subjects already understood. It is still uncertain how much original matter will entitle a book to free entry as one 'devoted to original research,' but a case which has come up recently in Philadelphia concerning the importation of a medical work has been appealed to the Circuit Court and may bring about a settlement of the question.

UNIVERSITY AND EDUCATIONAL NEWS.

THE annual report of the Provost of the University of Pennsylvania, with the appended documents, makes a volume extending to 248 pages. It covers, however, a period of more than two years, from June 9, 1894, when Mr. Harrison assumed the duties of acting Provost, to September 1, 1896. This will probably always be regarded as one of the most important periods in the history of the University. The preceding Provost, Dr. Pepper, had used his great energy and abilities to expand the University in every direction. Mr. Harrison has placed the external and internal affairs of the university on a firm basis. He has supplemented his own executive ability by a Vice-Provost, Professor Fullerton, whose knowledge of educational matters has greatly aided the reorganization of the University. This work has extended to every school and department, the standards having been raised throughout and the correlations improved. The chief losses to the scientific departments have been the death of Professor J. A. Ryder, and the resignations of Dr. John S. Billings and Dr. Harrison Allen; the chief gains have been the appointments of Professor C. A. Doolittle, in astronomy; Professor E. G. Conklin, in comparative embryology, and Professor A. C. Abbott, in hygiene. Of advances in the University the next noteworthy has been the gift of $500,000 by the Provost for the encouragement of liberal studies and the advancement of knowledge. Of nearly equal importance has been the erection of dormitories, and of Houston Hall, an admirable club house for students. In the scientific departments attention should be called especially to the work of the Wistar Institute and of the department of archæology and paleontology, and to the establishment of the Flower Astronomical Observatory and the Botanic Garden.

GENERAL J. WATTS DE PEYSTER will erect for Franklin and Marshall College, Lancaster, Pa., a library building with a capacity for 75,000 volumes.

PRESIDENT GILMAN, of John Hopkins University, has accepted the presidency of the Baltimore School Board.

FRANCIS E. LLOYD, professor of biology in the Pacific University, Forest Grove, Oregon, has been appointed professor of biological science in the Teachers' College, New York.

DR. ALEXANDER P. ANDERSON has been appointed professor of botany at Clemson College, S. C.

DR. JAMES WARD, fellow and one of the tutors of Trinity College, Cambridge, has been appointed to the newly established chair of mental philosophy and logic. The new University statutes passed in 1881 provided that professorships should be established in physiology, in pathology and in mental philosophy and logic as soon as sufficient funds could be provided from the common University fund and other sources. Accordingly a professor in physiology was appointed in 1883 and a professor in pathology in 1884. Owing to the decrease in the college revenues, the common University fund was found insufficient to justify the annual charge of £700, the stipend of the professor of mental philosophy and logic. As we have already reported that the chair was at last established by the Senate on December 10th with the assistance of a subscription from Professor Sidgwick.

PROFESSOR ALFRED HUGHES has resigned the chair of anatomy in the University College, Cardiff. He has granted to the College the free use of his anatomical collections, on which he has spent large sums of money and many years of labor. In the event of his wishing to remove these at some future period, he has placed at the disposal of the College a sum of money sufficient to replace them.

Dr. von Buchka has been appointed the successor of Dr. Eugen Zell in the Imperial Board of Health, Berlin, and has qualified himself as privat-docent in the University of Berlin. The subject of his inaugural lecture being 'The scientific basis of the newer development of analytic chemistry.'

DISCUSSION AND CORRESPONDENCE.

NOMENCLATURE OF METAMORPHIC LAVAS.

In the gold belt of the Sierra Nevada there are two very distinct sets of lavas. One of these is Juratrias in age or older, and is separated by a marked unconformity from a later set of lavas, chiefly of Tertiary age. The older set of lavas has been metamorphosed in varying degrees, so that at some points their original nature is not evident. Even where little altered they almost universally contain secondary minerals, such as epidote, zoisite, chlorite, uralite and calcite. The general appearance of these rocks and their mineral composition is, therefore, very different from the correspondng set of Tertiary lavas.

It is, therefore, very confusing to the general public to use the same set of names for the two sets of rocks. In the gold-belt region the older series of lavas has been compressed and infolded with the Juratrias and older sediments, which are called the auriferous slate series, since they contain by far the larger portion of the gold-quartz veins of the Sierra Nevada.

In many other parts of the world there are similar broad distinctions to be made between an older and younger set of lavas. It is very important that some method should be devised by which one may designate the fact that any given lava originally corresponded to a given type and at the same time express the fact that it has undergone metamorphism. This has been done in specific cases in various parts of the world. Thus Dr. Bascom, with the rhyolites expresses by the prefix *apo-* the fact that the rock, originally a glassy rhyolite, has undergone devitrification. The prefix *epi-* has also been used in some cases to express alteration. Thus the rocks called the epidiorite have been shown in many cases to have resulted from the alteration of diabase. The term metadiorite was used by Dana, and lately has been used by Cross and the writer, for diorites formed by the alteration of other rocks, without reference to their original character. None of these terms has thus far been used in a general way to express alteration in all of the altered lavas.

Dr. Bascom writes concerning the three prefixes that have been mentioned, as follows:*

"The prepositions *meta*, *epi* and *apo*, as prefixes, all indicate some sort of an alteration. Their exact force has been thus defined by Professor Gildersleeve: '*Meta* indicates change of any sort, the nature of the change not specified.' This accords with the use of the prefix by Dana in such terms as 'metadiorite' and 'metadiabase.' These terms have been recently revived to designate rocks 'now similar in mineralogical composition and structure to certain igneous rocks, but derived by metamorphism from something else.' *Epi* signifies the production of one mineral *out of* and *upon* another. This prefix has not been much used. We find it in such terms as epidiorite, epigenetic hornblende and epistilbite. *Apo* may properly be used to indicate the derivation of one rock from another by some specific alteration."

It is evident that Professor Gildersleeve's definition, that the prefix *meta* is the most logical one to use to express, in a general way, the metamorphic condition of altered rocks. Probably if the term had not already been used in certain specific senses there would be no objection to its adoption for this purpose, and speaking of meta-andesites instead of porphyrites; of meta-basalts instead of melaphyres, of meta-rhyolites instead of quartz-porphyries, and of meta-trachytes instead of orthophyres. This would express not only at once the fact that the rock was originally an andesite, basalt, rhyolite or trachyte, but also of the fact that it had undergone a metamorphism which would suggest the presence of the various secondary minerals which are almost always found in such altered lavas.

The adoption of this system of nomenclature is urged by the writer as a means of simplifying the very burdensome and unphilosophical series of names in use at the present time.

H. W. Turner.

U. S. Geological Survey,
January, 1897.

* Journal of Geology, Vol. I., p. 827.

THE LAW OF SIZE-WEIGHT SUGGESTION.

IN 1893 Dr. J. Allen Gilbert, working under my direction, obtained measurements on the size-weight illusion. A cylindrical block of 82 mm. diameter and of 55 g. weight was compared with a series of blocks of 35 mm. diameter but of various weights. The subject first lifted the large block, and then picked out, by lifting, that block of the series which appeared to be equal in weight to the larger one. The error in weight thus made was due to the suggestive effect of the difference in size.

These were the first measurements made on the size-weight illusion ('Studies from the Yale Psychological Laboratory,' 1894, II., 43).*

The problem was then investigated in detail by Dr. C. E. Seashore ('Studies from the Yale Psychological Laboratory,' 1895, III., 1). Two sets of cylindrical blocks were made. Set *A* varied in diameter, but had a uniform weight of 80 grams. Set *B* varied in weight, but were of a uniform size of 43 mm. The subject, lifting the block between thumb and finger, was requested to select for each block in *A* a block of equal weight in *B*. In this way the effect of size on apparent weight was determined.

In the 'Studies' for 1894 I had already pointed out the possibility of establishing the law of suggestion in such experiments. I now find it possible to do so on the basis of Dr. Seashore's work.

The curve conforms closely to the form $y = \frac{k}{x}$ which is the equation of a hyperbola referred to its asymptotes as axes with the constant k depending on the nature of the experiment. The actual measurements differ from the values required for this formula only by a small quantity $z = f(x)$, which expresses the apparent increase in the diameter of the block due to the contrast with the constant length.*

If the blocks of the *B* series be made of the constant diameter c and those of the *A* series of the constant weight d, and if we denote by s the difference in size acting as a suggestion, by i the resulting illusion and by k a constant depending on the nature of the experiment, then we have the general law

$$i = \frac{k}{s + c} - d,$$

which can be called the law of size-weight suggestion. Thus, in the first set of experiments c was 43 mm., d was 80 g., and k was determined by the facts: that the blocks were looked at while lifted; that the subjects were ignorant of the illusion, etc. In the other sets of experiments by Dr. Seashore k took other values.

E. W. SCRIPTURE.

YALE UNIVERSITY,
January 1, 1897.

* Professor Binet has called attention to the fact that he anticipated Gilbert by one month in measuring suggestion by his experiments on the length of lines. This, however, was quite a different form of suggestion. If the question is to be raised as to the first measurements of suggestion in any form, I am justified in claiming priority over Binet by the experiments briefly indicated in the *Educational Review*, 1893, V., 61.

* The exact values of z have not yet been determined experimentally. The results of a special investigation will appear in the 'Studies from the Yale Psychological Laboratory.'

SCIENTIFIC LITERATURE.

Round the Year: A Series of Short Nature-Studies. PROFESSOR L. C. MIALL, F. R. S. Pp. 290. Macmillan & Co. Price, $1.50.

The book is precisely what its title promises. Its author is a cultivated and observant scholar who loves nature and records her various phases after the manner of the old-time naturalist, though rectified by new-time science. It reminds one of White's Natural History of Selborne, and the author's familiarity with that classic has unconsciously led him into the amiable and homelike style of White, and this is to the merit of the book. He evidently has little sympathy for much that goes for modern natural history to-day. He says "natural history is being choked by unassimilated facts mechanically compiled by men who have apparently ceased to think about Nature. Hence a profuse and growing literature of the most melancholy description, dry, marrowless, useless. We record and record till our catalogues grow too voluminous for storage and too stodgy for the toughest appetite." The subjects discussed cover a wide range; we are led from Insects

and Plants in Mid-winter to Snow Flakes, Birds in Mid-winter, Animals with and without Combs, The Moon, the Oil Beetle, Buds, Dutch-weed, Flower-Haunting Insects and twenty-seven other equally diversified subjects. It is interesting to learn that "Jenner, the discoverer of vaccination, was accomplished in music, and studied natural history with diligence and success." He it was who made most valuable contributions on the habits of the cuckoo, the hibernation of the Hedge-Hog, and other subjects.

A curious mistatement is made on p. 53, where the author speaks of the pearl-forming Avicula as the shell which the Chinese utilize in making artificial pearl images. Any local shell collector would have told him that it was Hyria, a fresh water mussel, and not the marine Avicula, which the Chinese use for this purpose.

The illustrations are well chosen and clearly drawn. For teachers of elementary science and as a reading book for the higher grammar and even High Schools it may well be commended. E. S. Morse.

Researches on Mimicry on the basis of a Natural Classification of the Papilionidæ. By Dr. Erich Haase; translated by C. M. Child, Ph. D. 1896. Pp. 154, plates 8, colored, 4to. Nägele, Stuttgart.

It should interest entomologists, and general zoologists also, to know that an English translation of a part of Dr. Erich Haase's elaborate study of mimicry among the Papilionidæ has been published. The results of Dr. Haase's researches were originally published in two parts in Leuckart and Chun's Bibliotheca Zoologica.

The portion issued in English translation is Part II. of the study, and makes a quarto volume of one hundred and fifty pages with eight colored plates. The translator, Dr. C. M. Child, now of the University of Chicago, undertook his work at the suggestion of Dr. Leuckart, of the University of Leipzig, and has made a conscientious and idiomatic translation of this important contribution to the knowledge of mimicry. Dr. Child, though not a professed special student of insects, is known to entomologists through his excellent study of Johnston's antennal organ of hearing.

So much of our knowledge of mimicry has come through the study of the mimetic phenomena exhibited among insects, and especially among the butterflies, that it was to be expected that the first serious attempt to combine a study of phylogeny with a study of mimicry should have butterflies for its subject. Systematists have certainly not yet taken much into account the influence of mimicry in making forms of wide phyletic divergence superficially alike, or in making closely related forms superficially dissimilar. Yet mimicry produces exactly these conditions; and where so many members of a group, as Dr. Haase shows is true of the butterflies, owe the chief features of their habitus to the influence of mimicry, systematists have got to take this matter into account. And this will be good for us, for it will hold up very plainly to us one of the most interesting and instructive phases of the biological study of organisms. It may broaden some of us; it can narrow no one of us.

As much for its suggestiveness as for its light on the origin and development of mimetic coloration among the butterflies, entomologists should become acquainted with Dr. Haase's work. Vernon L. Kellogg.

Stanford University,
California.

SCIENTIFIC JOURNALS.

AMERICAN JOURNAL OF SCIENCE.

The February number opens with an article by C. E. Beecher, giving an 'outline of a natural classification of the trilobites.' This is the opening portion of a memoir which will be completed in the numbers immediately following. The author's extended study of this group has enabled him to reach definite conclusions, not only in regard to the position that the trilobites properly occupy as a group of the Crustacea, but also to give a systematic and minute classification of the families and genera. The subject is too special to allow of being developed here, but attention may be called to the plate in which certain typical forms are taken to show the principles adopted as the basis of classification.

Carl Barus describes a form of interferential induction balance and details some experiments to show what may be accomplished with it. This apparatus involves the principles of Michelson's interferential refractor, the iron cores of two like helices at right angles to each other being fastened at one end and free to move in the direction of the axes at the other. The interference fringes are visible whenever the excursions of the free ends of the cores are either zero or vibrating in the same phase, amplitude and period to and from the point of convergence; for other phases the fringes vanish more or less fully. In the course of one series of experiments to test the speed of transmission of electric impulses from one helix to another, the author concludes that an arrangement could be made which would indicate the retardation along something over a single knot of wire of high capacity inserted between the helices. This retardation would be exhibited by the passage of one yellow interference fringe across the spider lines of the telescope.

John Trowbridge and Theodore M. Richards discuss the multiple spectra of gases, as a continuation of their work on the spectra of argon described in the January number. They have experimented upon the spectra of nitrogen, hydrogen and other substances, with the result of confirming their former conclusion that the electrical conditions of the circuit have an essential influence in determining the character of the spectra obtained.

Theo. Holm gives the third paper of his studies of the Cyperaceæ. This is devoted to a morphological and anatomical study of *Carex Fraseri* and is illustrated by a plate.

T. A. Jaggar, Jr., describes a simple mechanical device for inclining a preparation in the microscope in petrographical study. It allows, for example, of a rapid determination of the optical orientation in feldspar sections and similar cases.

A. E. Verrill has two papers; the first on the nocturnal protective coloration in mammals, birds, fishes and insects as developed by natural selection. In this he calls attention to the fact that the color of many animals is such as to give them protection at night at the time when it is most called for. This is illustrated by a number of interesting examples. The second paper discusses the nocturnal diurnal changes in the color of certain fishes and of the squid (*Loligo*), with notes on their sleeping habits. When at Wood's Holl, Massachusetts, in the laboratory of the United States Fish Commission, in 1885–1887, the author had an opportunity to make observations on the marine animals in the aquaria between midnight and two o'clock a. m. Some remarkable cases of change of color were then noted. It is remarked that most fishes sleep very lightly and are aroused by almost imperceptible vibrations of air or water. Some of the fishes take remarkable attitudes while asleep.

The same author gives additional notes in regard to an enormous octopus, as it was supposed to be, which was thrown up on the Florida coast some weeks since. The body as preserved is some 21 feet long and is estimated to weigh between six and seven tons. The name *Octopus giganteus* is proposed for it.

O. C. Marsh has an article on the Stylinodontia, a sub-order of Eocene Edentates, in which a description is given, with numerous figures, of *Stylinodon mirus*, the type specimen as described in May, 1874. In regard to the origin of the Edentates the author repeats his remarks of August, 1877. He concludes by saying that the work of the past two decades has served to confirm the opinion that this group of mammals originated in North America and migrated from there to other parts of the earth where their remains have been found or living representatives are in existence.

The number closes with the usual chemical, physical and geological abstracts and notices.

AMERICAN GEOLOGIST, JANUARY.

SKETCH of W. W. Martin, accompanied by a list of official and professional positions held by him and a bibliography, by C. H. Hitchcock.

'The study of natural Palimpsests,' by G. P. Grimsley, gives a brief historical account of the discoveries in archæan and metamorphic rocks, and the methods employed in their study.

F. W. Sardeson continues his discussions on the Galena and Maquoketa series begun in the December number. Under the Galena series he recognizes the Beloit and Galena formations,

both of which are further subdivided into beds characterized by certain leading fossils. The Maquoketa series is divided into the Transition, Maquoketa and Wykoff formations, which also comprise beds marked by the presence of certain genera.

Jules Marcou has the first installment of a paper on 'Rules and Misrules in Stratigraphic Classification.' The early history of geologic correlation is sketched, and the independent discoveries of Giraud-Soulavie, William Smith, Cuvier and Brongniart are reviewed. Direct application is then made to American geological correlation, with special reference to the Taconic and Champlain systems.

'The relation of the streams in the neighborborhood of Philadelphia to the Bryn Mawr gravel,' by F. Bascom. With the exception of the large rivers, the streams of this region are shown to be of superimposed origin, having begun on a surface covered with gravel deposits, underlying which were older crystalline and paleozoic rocks. This has made their valleys quite independent of the strike or hardness of the rocks through which they are now cutting. The age of the Bryn Mawr gravels has been uncertain, and they have been referred to the Mesozoic, the Tertiary and the Quaternary by various observers. The author shows that they cannot belong to the Quaternary and inclines to the belief that they are a member of the Potomac formation, though the data obtained from the study of the drainage system may not be sufficiently exact to precisely determine their geologic relations.

SOCIETIES AND ACADEMIES.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO, MEETING OF JANUARY 6, 1897.

ABSTRACTS OF PAPERS PRESENTED.

I. MICROSOMES AND THEIR RELATION TO THE CENTROSOME.

THE problem of the centrosome presents itself under five heads:

1. The centrosome in caryokinesis of tissue cells.

2. The centrosome in the maturation of the ovum.

3. The centrosome in fecundation, or, more strictly, *the problem of the origin of the centrosomes which take part in the first caryokinetic division of the fertilized egg-cell.*

4. The centrosome in cells in which locomotor function is more or less well developed, as in leucocytes, pigment-cells, and some unicellular organisms.

5. The centrosome in some cells which undergo periodic growth, as in the sperm-mother-cell, the ovarian ovum, and some tissue cells. The centrosome in some ganglion cells probably belongs to this group of phenomena.

It was pointed out that these are coordinate features of one and the same problem. The different forms of the centrosome and their mode of origin, their variations under pathological conditions, their behavior during fertilization of the ovum in different forms, were examined in reference to two fundamentally opposed theories now current among cytologists.

In this connection a historical review of our knowledge of the microsomes (cytomicrosomes), as found in the observations of Hanstein, Schmitz, Schwartz, Strasburger, van Beneden, Boveri, Heidenhain, together with the author's observations on the ovarian ovum of an ascidian, was presented, and the bearing of the microsome question on the problem of the centrosome, pointing to the existence of homology between microsome and centrosome, was indicated.

The main conclusion of the paper was as follows: The living substance of the cell-body is to be regarded as composed of an element capable of dimorphic existence, with perfect freedom of transition from one to the other, under some definite condition. It can exist in the form of cytomicrosomes, or it can assume the appearance of clear, hyaline filaments, network, or vesicular structure, as the case may be. At one stage, the cell-body of a given cell, say an ovarian ovum of some organism, may be composed almost wholly of microsomes; at the next these microsomes may be transformed into hyaline cytoplasmic substance, with corresponding increase in the bulk of the cell.

In the phenomena of caryokinesis, fecundation, motion, periodic growth of the cell referred to at the beginning of the paper, both of

these cytoplasmic elements arranged in definite ways, come into play, and in the power of more or less rapid transition from one to the other is to be found an explanation of the main features of the phenomena, so far as the share of the cytoplasm, as such, is directly concerned in each process.

The results of these examinations, together with the author's unpublished work on *Ascaris*, in which it was shown that the centrosome in the *Ascaris* egg not only undergoes some periodic changes in its bulk, but totally disappears at a certain stage, were urged against the theory that the centrosome is a permanent organ of the cell.

S. WATASE.

II. CENTROSOME AND ARCHOPLASM.

A SUMMARY of the conclusions reached in my work on the egg of the earthworm (*Allolobophora fœtida*) follows:

1. The attraction spheres, both male and female, are of cytoplasmic origin.

2. The archoplasm is a specific substance, and not a mere thickening of the cytoplasmic network.

3. The microsomes are morphological elements and not merely varicosities of the cytoplasmic threads. They vary greatly in size, and many of them are unmistakably independent of the cytoplasmic reticulum.

4. Five observations were urged as evidence that the archoplasm is a specific substance and of a fluid nature. These observations were: (1) the relatively rapid movement of the substance, (2) the changes in its distribution caused by fixatives, (3) its transparent appearance in the living egg, (4) the cytoplasmic reticulum is not lessened by its aggregations, nor (5) disturbed by its migration.

KATHARINE FOOT.

III. CENTROSOME AND SPHERE IN THE OVARIAN STROMA OF MAMMALS.

THE cells of the ovarian stroma of some mammals (dog, rabbit) appear to undergo a peculiar change during pregnancy. The small, indistinctly defined, elongated or polyhedral cells are no longer seen, but their place is occupied by polyhedral cells of many times their size. The nucleus of these cells is regular in shape and contains numerous clumps of chromatin irregularly distributed. It does not usually lie in the center of the cell, but is displaced more or less toward one side. Around the central region of the cell is observed a distinct condensation of the cytoplasm, which is very conspicuous after double staining. It is not sharply limited from the remainder of the cytoplasm, but shades gradually into it. The whole cytoplasmic network, especially around the denser part of the condensation, shows a more or less distinctly radiate structure, though there are no distinct fibres. This structure can often be traced almost to the periphery of the cell. Within the condensed portion of the cytoplasm, at or very near a point forming the center of the radiate arrangement, lies a small, deeply staining granule or, in some cases, two. This granule is very clearly shown by the use of Heidenhain's iron-hæmatoxylin, after which it differs from all other extra-nuclear structures in the cell in retaining the dark blue or black. This body is undoubtedly a centrosome, and the condensation of cytoplasm around it undoubtedly represents a 'sphere.'

Now these cells are not preparing for mitosis, and, as far as has been found, there is no evidence of any future division. Whether the cells are in process of degeneration and are replaced by new cells after the period of gestation is ended, it has been as yet impossible to ascertain, but it is probable that they are not. Moreover, the steps in the appearance of the centrosome and sphere in these cells have not been observed, so that it is not known just when or how they first become visible. No trace of them has been found, however, in the stroma of ovaries from animals which are not pregnant or have not recently borne young, nor has any evidence of mitosis been seen in the stroma proper. Mitotic figures are occasionally seen in the cells of young corpora lutea. The functions of these structures under these conditions is not clear. The relation of the histological changes in the ovarian stroma to pregnancy also needs further study.

The presence of the centrosome and sphere in cells which are not undergoing mitosis presents a problem which is at present rather ob-

scure. They have been recently found and studied in the cells of the spinal and sympathetic ganglia of the frog (Lenhossék, Dehler), in the neurochord cells of an annelid (Miss Lewis) and in ganglion cells of a snail (McClure). They have also been found in connective tissue cells, pigment cells, resting leucocytes, etc. In the great majority of non-dividing cells, however, they have not been demonstrated.

It would appear, from the observations given above, that the centrosome and sphere may have some other function in the economy of the cell, in addition to their important rôle in the process of caryokinesis. In the case of the ovarian stroma the facts presented appear to favor the view that the centrosome, as such, is not a permanent organ of the cell, but may appear and disappear according to the conditions which prevail in the life of the cell.

C. M. Child.

IV. THE CENTROSOMES IN THE ANNELID EGG.

My observations have been made on the marine annelid *Chætopterus* in the endeavor to throw light on the following open questions:

1. Is there in the egg a definite structure—centrosome—not an artifact, and not identical with the 'centrosphere' or 'astrosphere'?

2. Is the centrosome 'a derivative structure arising by a modification of some pre-existing element in the cell,' or is it 'a permanent and ultimate organ of the cell, an organ *sui generis*, and coexistent with other ultimate organs of the cell, as the nucleus and the cytoplasm'?

3. Do the centrosomes grow, multiply by self-division, and persist from one cell generation to another, or are they formed anew in each cell in anticipation of caryokinesis?

4. What rôle does the centrosome play in fecundation—'its bearing on the phenomena of inheritance'? Is there a union of male and female centrosomes during fecundation similar to that of the male and female pronuclei—a 'quadrille of the centers'?

5. Whence come the centrosomes of the first and succeeding cleavage spindles?

6. What is the relation of the centrosome to the centrosphere (astrosphere)? To the cytoplasmic rays and network? To the Zwischenkörper?

If the eggs are kept in sea water for half an hour or more and not fertilized, all except the smaller ovarian eggs are found to have the first maturation spindle well formed, in its definitive position, and always in the same stage of development, *i. e.*, the metaphase or equatorial-plate stage. But if the eggs are preserved after having remained only a few minutes in sea water they are all, so far as my experience goes, found to contain the germinal vesicle and no spindle. I infer from this that sea water in some way stimulates the egg to the production of maturation spindles.

The smallest ovarian eggs are characterized by their relatively large nuclei and by their compact cytoplasm, which, devoid of yolk, stains a deep purple with our method—iron-alum hæmatoxylin and orange G. I can find in such eggs nothing resembling or indicating a centrosome.

Yolk granules which stain yellow soon begin to accumulate in the cytoplasm and the eggs grow larger. The yolk, however, is not at first distributed uniformly throughout the cytoplasm, but is most abundant near the periphery of the egg and frequently also immediately outside the nucleus. Where the yolk is present one can readily distinguish a cytoplasmic network, in the meshes of which yolk is held. The threads of the network have the appearance of minute granules arranged in linear order. They form a sort of membrane at the periphery of the egg, and are continuous with the nuclear membrane.

But up to the time when the egg has attained about two-thirds its full size there remain masses of cytoplasm containing no yolk and consisting of a network closely compact and staining dark purple. The component threads of these cytoplasmic masses are evident enough, and are continuous with the rest of the cyto-reticulum. These masses I consider to be equivalent to the *nebenkerne* or paranuclei of authors. They vary in shape and number in different eggs and at different stages of development, now appearing as one or two crescentic masses about the nucleus, and now broken up into many pieces. Their fate is always the same; they gradually fray out and become resolved into the general cyto-reticulum.

When the last traces of the paranucleus have vanished the cytoplasm presents a nearly uniform appearance throughout. The reticulum is characterized at this stage by the decidedly granular composition of the fibrils and the circular appearance of the meshes as seen in section, and also by the uniform distribution of yolk throughout the egg.

Although the structure of the reticulum, the peripheral egg membrane (pellicle) and nuclear membrane are beautifully clear and easily demonstrable, there is *as yet no trace of anything suggesting a centrosome.*

Soon after this, as the egg grows larger, the cytoplasmic threads show a tendency to an arrangement in straight lines rather than curves, so that the outlines of the meshes are polygonal rather than circular. Eggs which have reached this stage in development, when placed in sea water, continue to develop as far as the formation of the first maturation spindle. The tendency of the fibrils of the network toward straightening out becomes accentuated, so that many of them extend in straight lines for a distance several times the diameter of the single meshes. Moreover, these longer fibrils radiate from common centres, and in this way there arises in the cytoplasm a number of *miniature asters.* At first only two or three rays may be seen; then they increase in number and length at the direct expense of the remaining network. The aster formation continues until a climax is reached, when one can count no less than *seventy-five distinct asters* scattered about through the cytoplasm in the vicinity of the meshes. (Many of them are half way between nucleus and periphery of the egg.) These asters repel the yolk as do those of the caryokinetic spindle.

The period of development characterized by multiple asters is not of long duration. Two of the asters gain predominance over the others in point of size, and continue to grow larger, while the others gradually evanesce. The two larger asters I will call *primary*, and the others *secondary* asters, following Reinke, who has described a similar aster formation in the peritoneal cells of the larval salamander.

Whether the primary asters are formed directly by an actual union and evanescence of several of the secondary asters, I am not prepared to say at present. Many things indicate that this is the case. At any rate, the two primary asters continue to grow; a minute dark brown sphere, the centrosome, appears in the center of each, itself surrounded by a lighter brown area, astrosphere, or centrosphere, from which the purplish rays diverge in every direction. I am convinced that these two asters and their centrosome are formed by a modification of cytoplasmic structures. They usually *arise at a considerable distance from each other* and from the germinal vesicle, and while the nuclear membrane and the nucleolus are still intact. *They are the asters and centrosomes of the first maturation spindle.*

After the spindle is formed, it remains for a little while near the germinal vesicle. Each centrosome divides into two; the nuclear membrane disappears; the chromosomes and the nucleoli are drawn up to the region of the equator of the spindles, and the whole spindle swings around to its definitive position at the periphery of the egg, and perpendicular to the surface. The light brown astrospheres at the poles of the spindle contain each a pair of centrosomes. The spindle remains in this condition until the egg is fertilized.

I have artificially fertilized the eggs of *Chætopterus* after they had been in sea water an hour and twenty minutes, yet they developed normally. Immediately after the entrance of the sperm the maturation processes are resumed. The first maturation spindle, which has remained up to this time in the equatorial-plate stage, now passes through the succeeding phases of mitosis, which result in the formation of the first polar globule. During these processes the two centrosomes in the aster at the inner pole of the spindle move apart, and a small central spindle is formed between them. The centrosphere fades away and the rays of protoplasm converge to the two centrosomes. The centrosomes at the outer pole of the spindle are carried into the polar globule and there degenerate. A delicate Zwischenkörper is formed at the junction of the polar globule and egg, but it soon vanishes and has nothing to do with the formation of the second maturation spindle. (Compare Mathews, Jour. Morph. X., No. 1, p. 334.) The small spindle before

mentioned becomes the second maturation spindle by means of which the second polar globule is extruded.

The two centrosomes, which, as we have seen, are identical with those in the inner aster of the first maturation spindle, move still further apart and, with spindles between them, take a position on either side of the group of chromosomes left in the egg after the first division. Tho chromosomes are arranged in the equatorial plate, and the whole spindle swings around to an approximately vertical position directly under the first polar globule. The radiations from both ends of this spindle are long and conspicuous. The centrosome at the inner end usually, perhaps always, divides into two. It is surrounded by a small centrosphere.

The second polar globule is formed by the usual process of mitosis. In the second polar globule, as in the first, there can be seen for a time the degenerating centrosome of the outer pole of the spindle. A Zwischenkörper is formed, consisting at first of a circle of small dots, like the middle plate of plants, with rays extending in both directions. Later it becomes constricted to a single center with diverging rays, and in this condition it is distinguishable until the pronuclei have nearly united. The chromosomes left in the egg at the inner end of the spindle group themselves so as nearly to surround the centrosome and its astrosphere. The rays of the latter are numerous and long, extending through half the diameter of the egg.

The nine chromosomes swell up into as many vesicles which migrate toward the middle of the egg, and as they do so unite to form one large female pronucleus. The aster and centrosome are carried along with the vesicles for a certain distance, but degenerate before the vesicles have united. The rays of this aster, which were very strongly developed when the vesicles were first formed, become weaker and weaker, and finally disappear entirely. While they are still present they converge to the center of the group of vesicles and indicate the position of the centrosome.

While the processes of maturation have been going on, the entrance of the sperm has wrought profound changes in other parts of the egg. The sperm may apparently enter the egg anywhere. Soon after it has entered we find near it a minute aster with two centrosomes close together. They lie in a minute astrosphere from which a few short rays diverge.

These two centrosomes are known as the 'male centrosomes,' though in *Chætopterus* I am not sure that they are actually carried in by the spermatozoön. A strong presumption is created in favor of this view by the fact that the sperm has in the middle piece two bodies resembling centrosomes. However this may be, the male centrosomes separate as the head of the spermatozoön enlarges, to form the male pronucleus, and as they separate, the rays diverging from them become more and more extensive.

Besides moving apart, the centrosomes migrate toward the center of the egg, the male pronucleus accompanying them, sometimes on one side and sometimes on another, but always near at hand. They finally take a definite position a little to one side of the center of the egg and toward the polar globules. The central spindle which has developed between them lies at right angles to the egg axis. At this time nearly all the cytoplasm of the egg appears in the form of varicose fibrils, radiating directly from the two male centrosomes.

These enormous male asters are the poles of the first cleavage spindle. They are already connected by a central spindle. The pronuclei come together between the poles and elongate slightly. The nuclear membrane disappears; the chromosomes arrange themselves in the equatorial plate usually in two distinct groups, and we have the first cleavage spindle in the metaphase.

During the formation of the cleavage spindle a centrosphere develops about each centrosome, and the rays become very much shorter, for their distal portions break up to form again a cytoreticulum.

While the chromosomes are undergoing the longitudinal splitting, each centrosome divides into two in anticipation of the next cleavage. The two daughter centrosomes move apart in each astrosphere without disturbing the spherical shape of the latter, until the beginning of the telaphase, when the chromosomes at either

pole of the spindle commence to swell up into vesicles in preparation for the reconstitution of the nuclei. Then the centrospheres fade away and the centrosomes with the central spindle between them move further apart to opposite sides of the new nucleus. At this stage we find once more the enormous radiation directly from the centrosomes which involves nearly all the cytoplasm in the egg.

When the new nuclei have reached the so-called resting stage the centrospheres develop again, the distal part of the rays break up into the network, the centrosomes divide, and the processes just described are repeated.

With each cleavage a beautiful Zwischenkörper is developed. It consists at first of a circle of small dark bodies staining like the centrosomes, each with a brush of fibrils diverging toward the newly formed nuclei. At a later stage these bodies all become compressed into a single mass and lose their individuality.

The phenomena exhibited in the egg of *Chætopterus* lead me to the following conclusions:

1. That there is in the egg a definite body—the centrosome—which is not an artifact nor a myth, and which is not identical with the centrosphere or astrosphere, though the latter is sometimes present.

2. That in the oocyte of the first order, *i. e.*, the unmaturated egg, the centrosome arises by a modification of pre-existing cytoplasmic structures.

3. That the centrosomes, whatever their origin, are capable of growth and multiplication and persist through at least several cell generations.

4. That there is no union of male and female centrosomes during fecundation—no quadrille of the centers. The female centrosomes, on the contrary, entirely degenerate, and therefore the centrosomes cannot be considered a special means for conveyance of hereditary qualities.

5. The centrosomes of the first and succeeding cleavage spindles are identical with, or derived directly from, the male centrosomes, which are probably brought into the egg with the middle-piece of the spermatozoon.

6. The centrosphere, a differentiated region about the centrosome, gives a different reaction from the centrosomes, on the one hand, and the rest of the cytoplasm on the other, both in point of color and resistance to certain reagents.

Corrosive, acetic and other reagents will sometimes completely destroy the centrosphere, though the rays and other structures are fairly well preserved.

The centrospheres, unlike the centrosomes, come and go with each succeeding caryokinesis. When they are present, the cytoplasmic rays of the aster are less strongly developed then when they have disappeared, and the rays diverge directly from the centrosomes themselves.

The centrosomes divide and move apart within the centrosphere for a considerable distance without altering the shape of the latter.

A. D. MEAD.

V. THE CENTROSOME PROBLEM AND AN EXPERIMENTAL TEST.

IT is now generally supposed that the centrosome represents 'the especial organ of cell division,' 'the dynamic center of the cell.' The outcome of investigation as generally understood is well stated by Dr. Wilson in his recent work on 'The Cell' (p. 171):

"From the father comes the centrosome to organize the machinery of mitotic division by which the egg splits up into the elements of the tissues, and by which each of these elements receives its quota of the common heritage of chromatin. Huxley hit the mark two score years ago, when, in the words that head this chapter, he compared an organism to a web of which the warp is derived from the female and the woof from the male. What has since been gained is the knowledge that this web is to be sought in the chromatic substance of the nuclei, and that the centrosome is the weaver at the loom."

The evidence as to the origin and function of the centrosome is not all in yet, and some of what is in cannot be easily reconciled with these generalizations. How very difficult it is to reach certainty in observations on this structure, no one knows by his own experience better than Dr. Wilson himself. That the centrosome comes from the mother in parthenogenetic eggs is one fact about which no doubt

can be raised. Two cases are now known in which the same thing is claimed for fertilized eggs (*Myzostoma*, *Unio*), and the work of Miss Foot on the egg of *Allolobophora fœtida* suggest that the so-called sperm-aster may not, after all, be a derivative from the sperm. Mead's discovery of numerous asters in the unfertilized egg of *Chætopterus* suggests that these structures and the centrosome as well are but transient figures of the cytoplasmic network—figures that may appear at any number of points of the cell body on occasion. In that case their disappearance would not indicate degeneration, but merely a return to the reticular condition, a resolution of figure rather than of substance. This view would accord with the theory of the centrosome advanced by Dr. Watase.

The question as to which sex determines the pace of development, or whether both sexes share in this determination, is one for which it is possible to find a crucial, experimental test. My experiments are not yet concluded, but they already furnish a decided answer to the main question. The experiments are made by crossing different species of pigeons having different incubation periods. The crosses first made, and the only ones thus far fruitful, were between the common dove ♂ and the ring-dove ♀ (*Turtur risorius*). The incubation period of the male species is from 18 to 20 days, while that of the female species is from 14 to 15 days. If the male furnishes the centrosome we should expect to have the rate of development retarded and the incubation possibly prolonged to the time of his species. In the reverse experiment, with a male *T. risorius* and a female common dove (experiment now in progress), the rate of development would be accelerated, and the time of incubation correspondingly shortened. One pair have hatched young three times, each time in the period of the mother. A second pair (♂ = a fantail) have hatched once, also in the regular time of the mother. The young birds were perfectly formed.

These experiments show that the rate of cell-formation and embryonic development up to the time of hatching is determined by the sex that furnishes the egg. Some marks of paternal derivation are already visible in the newly hatched hybrid, *e. g.*, color of the beak and character of the down. The male influence is most predominantly marked in the later development and color of the plumage.

C. O. Whitman.

BIOLOGICAL SOCIETY OF WASHINGTON, 270TH MEETING, SATURDAY, JANUARY 16.

Theo. Holm showed the Society a botanical work printed in the year 1549, in which binomial nomenclature was in use. This book was Leonhart Fuchs' Historie des Plantes, and it was surprising to see that several of our common plant-names used to-day were also known at that very early date, for instance: *Vitis vinifera*, *Aconitum lycoctonum*, *Angelica silvestris*, *Digitalis purpurea*, etc.

Mr. Holm also showed the first and the last volume of the famous work 'Flora Danica,' which contains illustrations of 3,240 plants from Denmark, Norway, Sleswic, Færœ islands, Iceland and Greenland engraved on copper. This work was begun in the year 1761, the expense being paid by the Danish king until 1883, when the publication was brought to a close. The botanical editors of the work were Oeder, O. F. Mueller, M. and I. Vahl, Hornemann, Drejer, Schouw, Leibmann, Japetus Steenstrup and Lange, while six Danish kings contributed the funds necessary for the publication of this voluminous opus.

Mr. Holm thereupon showed a specimen of the interesting *Draba hyperborea*, which had lately been collected by Mr. Macoun on the Pribilof Islands. This species is not only of gigantic size in proportion to the other species of *Draba*, but it is also most characteristic in having a monopodial ramification. The species of *Draba* are generally annual, biennial or perennial, but have constantly a terminal inflorescence. In *Draba hyperborea*, on the contrary, the bud is terminal, but purely vegetative and lasts for several years, while the inflorescences are all lateral. A similar case was known to the speaker to exist in *Arabis dentata*, which, in this respect, showed a difference from most of, if not all, the other species of *Arabis*.

W. T. Swingle exhibited specimens of two simple algæ from the Gulf of Naples, remarkable for the great size of the apicial cells. Although very similar in appearance, these two

species differed fundamentally in the manner of their growth.

Specimens of two poisonous plants were exhibited by V. K. Chesnut. The first was a new species of Water-Hemlock (*Cicuta vagans* Greene), the rhizome of which is poisoning cattle in Oregon and Washington. The second was the oleander or Laurier Rose (*Nerium oleander* L.). This plant was recently mistaken at Jesus Maria, Chihuahua, Mexico, for the mountain, or rose, laurel (*Kalmia latifolia* L.). An extract was made from the leaves, which was added to honey and fed to some bees at that place. They were not poisoned by it, but the honey deposited by them proved to be very deleterious to two persons who ate from it. The mistake in the identity of the species was revealed by specimens obtained from the experimenter.

Under the title 'Unity or Plurality of Type Specimens in Paleontology,' Mr. David White called attention to the difference of opinion and usage between botanists or zoologists and paleontologists, particularly paleobotanists, respecting the application of the word 'Type,' such differences arising largely from the dispersion of the parts of plants and the conditions of preservation. Owing to the conditions of fossilization, most species of fossil plants are originally based on several specimens, each of which contributes characters not seen in the others. Such are coordinate or 'Co-types.' For specimens, such as fruits, leaves, preserved tissue, etc., serving as the source of additional specific characters, subsequently described or illustrated, the name 'Supplementary Type,' was advocated. Mr. White urged that any paleontological specimen that has furnished new specific characters for incorporation in the diagnosis, or for illustration, is thereby removed from the level of other specimens in the collection, and therefore deserves an appropriate designation, according to circumstances. Preferring for such purpose some qualification of the word 'Type,' he tentatively suggested for certain presented cases the terms 'Subsidiary Type,' 'Continental type,' etc.

Mr. White also exhibited specimens of 'A New Lycopodineous Cone from the Coal Measures of Missouri,' at Clinton, together with its bracts, presented to the National Museum by Dr. J. H. Britts. These illustrated his previous remarks, the former belonging to the genus *Lepidostrobus*, the latter of the genus *Lepidophyllum*.

Mr. Edward L. Greene spoke of the 'Development of the Idea of a Genus,' as shown in the works of the earlier herbalists and botanists.

Mr. M. A. Carleton presented a paper on the 'Ontogenetic Separation of Puccinea graminis Avenæ from P. graminis Tritici.'

The forms of *Puccinia graminis*, or stem rust, on wheat is quite distinct from the one occurring on oats, though until recently they have been considered identical. The distinction is founded mainly upon this behavior in artificial inoculations, though there are probably other reasons for separating them. The form on oats can not be transferred to any other cereal. The form on wheat is readily transferred to barley, and probably occurs on rye, and, with still less certainty, on oats. In inoculation experiments the form *Avenæ* infects 21 species of Graminæ in 18 genera. Similar experiments with the form *Tritici* are not yet completed. Eriksson has obtained like results, as a rule, in Sweden.

F. A. LUCAS, *Secretary*.

ENTOMOLOGICAL SOCIETY OF WASHINGTON, JANUARY 7, 1897.

MR. ASHMEAD exhibited an agamous female of *Belenocnema treatæ* Mayr. The true sexual generation consists of winged males and females issuing from galls on the roots of live oak, while the agamous generation consists of subapterous females issuing from a gall which occurs on the leaves. Mr. Ashmead has connected the two galls simply from a study of structural characters of the adult insects.

Professor J. B. Smith, a corresponding member, gave a brief review of a classification of the orders of insects, as a result of a series of studies made during the past few years. He proposes to divide the true 'Insecta' primarily into two series upon the character of the mouth-parts, making one a suctorial type to contain the orders Thysanura and Rhyngota. All the others are mandibulate in some stage of their existence. These mandibulata he divides into three other series, according to the development of the prothorax. In one case the prothorax is entirely free in the adult, and

this series contains the Dermaptera and Coleoptera, in which the hind wings are transversely folded, and the Plecoptera, Platyptera and Orthoptera, in which the hind wings are longitudinally folded beneath the primaries. The second series is that in which the prothorax is fairly well developed, but is quite closely attached at its base to the other segments, and is not freely movable, as in the case of the first series. In this branch, which was terrestrial from the start, are included the Isoptera, Mallophaga, Corrodentia and Neuroptera. The third series had the prothorax reduced in size from the beginning, and always united to the other thoracic segments, the general tendency being towards a complete loss of function of all save the legs in this part. All the members of this series are from an aquatic form, and they include the Odonata, Ephemerida, Trichoptera, Lepidoptera, Mecoptera, Siphonaptera, Diptera and Hymenoptera. From the Neuroptera, as generally understood, he separates the Sialidæ, which he makes, with its relatives, an order under the term Platyptera.

This paper was actively discussed by Messrs. Banks, Gill and Ashmead, who criticised details rather than the general ideas expressed.

Dr. A. D. Hopkins, a corresponding member of the Society, presented some notes on Scolytidæ, with descriptions of four new species, viz.: *Pityophthorus frontalis*, a species which infests dead oak twigs; *P. fagi*, which infests peach twigs; *Thysanoes querciperda*, infesting oak, and *T. obscurus*, reared from hickory twigs.

L. O. Howard,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 56th meeting of this Society, held in Washington, D. C., January 13, 1897, communications were presesented as follows:

The Measurement of Faults: J. E. Spurr, U. S. Geological Survey. Faults are simple movements in the rocks of the earth's crust along fracture planes, and, since these planes may stand in any attitude, there is no rule by which the nature of a fault may be judged beforehand. The *existence* of a fault can be determined by the evidences of friction along the plane of motion, such as fault breccia, polished and striated rock faces and so on; the amount of movement, however, can be completely ascertained only by the aid of independent and accidental phenomena. In homogenous rock masses the amount of movement cannot be ascertained; in heterogeneous rocks it may ordinarily be ascertained with greater or less accuracy, and the variations in rock masses must be used as criteria. The commonest variations which are constant enough to be reliable as data are sedimentary beds, and hence it is easy to fall into the error of considering faults simply as dislocations of strata. In careful geological work, however, any available criterion must be regarded as of as much value as any other; in mining geology the most valuable are, besides sedimentary beds, igneous bodies (such as dikes), bodies of ore, striæ on the fault plane, showing direction of movement, and the composition of the fault breccia, which may show in some degree, the amount of movement.

In seeking to measure a fault it is necessary to have clearly in mind some of the principal functions of fault movement. Among these functions certain which are of greatest importance are adopted and defined. These are: *Total displacement, lateral separation, perpendicular separation, throw, vertical separation* and *offset*. The number may be increased indefinitely, yet ordinarily this is undesirable.

Glaciation of Puget Sound Region: Bailey Willis. During the past season the drift deposits about the southeastern edge of Puget Sound have been studied in some detail. They are found to consist of several beds of till, separated by stratified deposits of clay, sand and coarse gravel, together with widely distributed lignite beds. The character and extent of the glaciation of the Puget Sound region are indicated in these deposits, and it is found that the principal flow of the ice was rather from the north than from the mountains on the southeast. Two problems are presented by the phenomena: (1) the sequence of glacial advance and retreat, and the extent and duration of climatic changes indicated by the presence of lignites; (2) the bearing of the peculiar conditions of glacial development upon the physiography of the sound. Either the deeper valleys of the sound have been eroded during a period of high level from

the once more extensive sheets of drift, or, as suggested by Russell, the channels represent the beds repeatedly occupied by glaciers which, in their advance and retreat, built up the plateau-like eminences of the region, probably upon the divides of the pre-existing topography. The past condition of Puget Sound under confluent glaciation is probably now represented by the Malaspina glacier and its attendant phenomena.

W. F. MORSELL.

U. S. GEOLOGICAL SURVEY.

NEW YORK ACADEMY OF SCIENCES.

THE Geological Section met January 18th, and listened to the papers of which abstracts are given below. Both will appear in full in the Transactions.

The first paper was 'Notes on the Geology of the Bermudas,' by J. J. Stevenson.

After describing the several types of rock deposits and their relations, as well as the surface features of the area, Professor Stevenson offered the following conclusions respecting the successive conditions:

First: The Limestone or 'base rock' of the island was formed by accumulations of dune sand. During a prolonged period of quiet, this rock underwent great erosion, both surface and subterranean; the collapsing of cavern roofs caused great 'sinks,' some of which, no doubt, still exist as such, though to distinguish them from those of later origin would be difficult.

Second: A period of subsidence followed, during which the land sank 120 feet or more; marine deposits encroached upon the land, extending through valleys, thus giving beach rock at widely separated localities and in somewhat anomalous positions.

Third: Succeeding this was a period of quiet, during which the Sandstone was formed, as the Limestone had been, by accumulations of dune sand and the great 'sinks' were filled up, as the basins of Castle harbor are now filling.

Fourth: A period of elevation followed, during which the land must have risen to at least its former level. The old subterranean drainage system must have been re-established in many instances and the former depression cleaned out; while near systems may have been formed, causing new groups of depressions.

Fifth: This was succeeded by a period of subsidence, during which the land sank to very nearly the same position as at the maximum of subsidence in the previous period, the highest marine beds being now only a few feet above the water's edge. The more important bodies of water began in the deeper depressions early in this period, but they assumed their present forms, due to shore erosion, only in the later portion, when the subsidence was very slow and evidently interrupted more than once by prolonged periods of quiet.

The paper was well illustrated by the lantern.

The second paper was 'The Geological Section at Cliffwood, N. J.' by Arthur Hollick.

Mr. Hollick described the Cretaceous clay marl in the vicinity of Cliffwood, New Jersey, one of the localities where the fauna of the horizon has been collected and the only one at which any fossil plants have been found.

The strata in question are the equivalent of the Matawan formation of Professor W. B. Clark, which represents the transition from the plastic clays of the Raritan formation below to the greensand marl above, and, as may be expected, shows a commingling of fresh-water, land and marine conditions. The specimens collected consist of crustaceans, leaves, fruit and twigs of trees and masses of lignite. The crustaceans are too fragmentary for exact determination. About 15 species of mollusks were identified and 26 species of plants, the majority of the latter belonging to the Coniferæ. Of these, nine are here described as new species. The paper was illustrated by maps of the region, by drawings of the specimens and by the specimens themselves.

J. F. KEMP,
Secretary.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

BY invitation the New York Section of the American Chemical Society held an informal dinner at the Knickerbocker Athletic Club, Friday evening, January 8th, after which the regular monthly meeting was convened in one of the assembly rooms of the club, about fifty-five members being present.

The chair was taken by Dr. McMurtrie at 8.15, and, after routine business had been disposed of, the reading of papers was then taken up as follows:

'Note on an Improved Specific Gravity Bottle for Liquids,' by Dr. E. R. Squibb; 'Note on the Determination of Caffeine,' by G. L. Spencer; 'Variations in the Composition of Commercial Red Lead,' by Durand Woodman; 'The Methods for Determination of Tannin,' by J. H. Yocum; 'Modern Metallurgy of Copper,' by J. B. F. Herreshoff.

Mr. Spencer reviewed the precautions necessary in the determination of caffeine by both Gromberg's and the gravimetric method, and concludes that the Gromberg method gives the most satisfactory results, and admits of wider application than the gravimetric method, particularly as by the latter it is difficult to obtain absolutely pure caffeine.

Dr. Woodman gave the results of a series of factory tests on commercial red leads, taking the position that the litharge removed by digestion in solution of lead acetate is simply that portion which has escaped oxidation, and is therefore a diluent merely, and a measure of the incompleteness and imperfection of the roasting process. He finds no uniformity in the amounts of the uncombined or free litharge, either in the samples which are the subject of his paper or as reported by other analysts. According to his determinations the following variations are shown:

	1	5	B.W.L.	64	C.	L.B.	B.W.L.	L.B.
Red lead...	51.0	41.0	60.0	28.0	58.0	90.0	73.5	87.5
Free litharge...	49.0	59.0	40.0	72.0	42.0	10.0	26.5	12.5

For present purposes the few per cent. of impurities were not determined, and are included, some in the red lead figures, and others in the litharge.

Mr. J. B. F. Herreshoff made an address on 'Modern Metallurgy of Copper,' reviewing briefly the historical side of the development of the copper industry in this country and pointing out the remarkable increase in its consumption, due to the advance in the applications of electricity. While the iron industry of this country is always spoken of as so enormous, and is indeed of great magnitude, it is only known to those who follow the subject very closely that the production of copper amounts to over one-half of the value of pig iron annually produced.

In 1895 the United States consumed 62.6 per cent. of its production, but in 1896 the home consumption was only about 37.5 per cent., 62.5 per cent. being exported. In the same time there was also a large increase in production.

Mr. Yocum reviewed the methods (and difficulties inherent in them) of determining tannin in barks and extracts. He considers a complete extraction of tannin at low temperatures as an impossibility, regardless of the amount of water used.

Durand Woodman,
Secretary.

The Academy of Science of St. Louis.

At the meeting of the Academy of Science of St. Louis on the evening of January 18, 1897, Professor H. S. Pritchett presented some results of observations on the recent sun-spots, prefacing his remarks by a general account of our present knowledge of the constitution of the surface of the sun, and of sun-spots in general, and illustrating his remarks by the use of lantern slides.

Two persons were elected to active membership.

Wm. Trelease,
Recording Secretary.

NEW BOOKS.

Problems and Questions in Physics. Charles P. Matthews and John Shearer. New York and London, The Macmillan Company. Pp. vii+247. $1.60.

The Mechanics of Pumping Machinery. Julius Weisbach and Gustav Herrman. Authorized translation from the second German Edition by Karl P. Dahlstrom. London and New York, The Macmillan Company. 1897. Pp. 300.

The Story of Extinct Civilizations. Robert E. Anderson. New York, D. Appleton & Company. Pp. 213.